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Devoted to all problems of Child Health in Sub-Tropical and Tropical Countries of the world

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Devoted to all problems of Child Health in Sub-tropical and Tropical Regions.

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EDITORIAL

Kuru

Recent work by Gajdusek[1 2] and his associates in the remote hinterland of New Guinea has drawn attention to an apparently new syndrome, known as "Kuru," and characterised by progressive, and ultimately fatal, degeneration of the central nervous system, especially with dementia and cerebellar signs

What makes the condition particularly intriguing is the fact that, far from being a rare curiosity, in the Fore region it has been assessed that "Kuru" is the cause of 46 per cent of the fatal mortality at all ages, so that locally it is plainly a public health problem of considerable size and importance

While extremely detailed investigations are continuing into the patho-physiology and epidemiology of "Kuru," present views are that it is mainly, if not entirely, a genetically acquired condition, which, because of the probably highly inbred population among these mountain peoples, affects a large number of them The age incidence is interesting, in that, while children over the age of five years show an equal sex distribution, the main emphasis falls on adult women, full-grown males being only occasionally affected

Despite differences in prevalence in different parts of the world, a disease entity is rarely confined to one geographical area of the globe, so that one wonders if "Kuru" is waiting to be discovered elsewhere In addition, it is, of course, quite possible that other genetic abnormalities may be yet to be described in other traditionally recluse mountain communities, as may, for example, be found in parts of Abyssinia and among Himalayan hill tribes

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CORRESPONDENCE

To the Editor

SIR,—On reading the report of the Committee investigating the sudden deaths of infants in England and Wales(1), I was surprised at the similarity of the circumstances under which these unexplained deaths occurred and the sudden deaths of breast-fed infants of B_1 avitaminotic mothers in Hong Kong (who often seemed apparently healthy)(2) :

(i) Sudden attack and death : mothers often reported that apparently healthy infants were found dead in the morning, or that the infants suddenly turned blue and died.

(ii) Cyanosis : owing to its presence asphyziation due to charcoal fumes was occasionally suggested (presumably through mechanical obstruction), as mothers often carry their babies on their backs whilst cooking (soft pillows are conspicuously absent in China).

(iii) The age : the most critical age is the first four months. Actually, Chinese in Hong Kong consider the first 100 days as the most dangerous ; therefore, on the 100th day there is a celebration.

(iv) Absence of any definite pathological findings to account for death.

(v) Preponderance for male infants : in China, male infants are more valued and therefore are more often breast-fed. There was a case of heterogeneous twins ; the male baby, being breast-fed, died suddenly, whereas the female baby, being artificially fed, was apparently healthy.

(vi) Increased incidence in winter : some protective foodstuffs are scarce or unavailable in winter.

(vii) Incidence of bronchitis : in the less acute cases, slight bronchitis is almost always present ; however, the condition is not alarming and therefore one is shocked when a mother reports that the baby died suddenly. Such babies appear to have decreased resistance to infections producing slight oedema of the upper respiratory tract.

The term " infantile beri-beri " given to such a condition in infants is most misleading, as it suggests tropical countries and severe malnutrition, whereas this disease might occur in any country where refined carbohydrates are the staple foods of the population. Therefore " human milk intoxication " would be a better term — such a term would also cover other metabolic disorders of mothers, e.g. diabetes, etc.(3)

LYDIA FEHILY, M.D.

Palma,

Majorca.

(1) *Daily Telegraph.* December, 1958.
(2) Fehily, L. (1941). *J. Trop. Med. Hyg.*
(3) ——— (1944). *Brit. med. J.*

ANAEMIA IN KWASHIORKOR

by

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Kwashiorkor is a disease of infancy and childhood found in all the underdeveloped countries where ignorance is rife, poverty universal and first class protein expensive and in short supply. In South Africa, it is confined to the coloured communities. In Durban the clinical picture, as recorded elsewhere (WALT *et al.*, 1950), is very similar to that in other countries. The principal features are generalised oedema, dermatoses, dyspigmentation of hair and skin, hypoproteinaemia and retardation of physical development. As occurs elsewhere, it is very commonly complicated by such infections as dysentery, gastro-enteritis, pneumonia, upper respiratory infections and tuberculosis ; although helminthiasis is common, it seldom causes serious ill health or anaemia in Durban.

Anaemia was found in almost every child with kwashiorkor studied by us and it is the anaemia in our patients which has interested us considerably. Anaemia is diagnosed when the haemoglobin is below 11 g. per 100 ml. because this is the level one would like one's patients to achieve and is also the level suggested by TROWELL (1956).

Various types of anaemia have been described by many workers in a syndrome apparently identical with kwashiorkor. Some anaemias are normochromic and normocytic (ALTMANN and MURRAY, 1948 ; ADAMS, 1954), others megaloblastic (AMATO, 1946 ; GERBASI and BURGIO, 1955), and others hypochromic (TROWELL and SIMPKISS, 1957). Almost every worker has attributed the anaemia to different causes such as associated infections or lack of protein (WOODRUFF, 1955), or iron or folic acid. In previous studies (WALT *et al.*, 1956 and 1957) it became apparent that patients almost invariably remained anaemic even after recovery from kwashiorkor and despite active treatment directed at the anaemia. It is this persistent anaemia that I wish to discuss with particular reference to the common features it presents during therapy. It is hoped that these findings may indicate lines for further investigation. I propose to discuss briefly the megaloblastic anaemia which also occurs in some of our cases of kwashiorkor.

TYPES OF ANAEMIA IN KWASHIORKOR.

The two principal types of anaemia are : (i) Megaloblastic, (ii) Normochromic normocytic.

(i) *Megaloblastic Anaemia.* Megaloblastosis is a common complication of kwashiorkor and it is estimated to occur in 15 per cent. to 20 per cent. of our patients. In 1957

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* My thanks are due to Dr. [illegible], Medical Superintendent, McCord Zulu Hospital for facilities and help ; to Dr. S. [illegible] protein estimations ; to [illegible] and peripheral bloods ; to [illegible] Natal for his c[illegible] Department o[illegible] 1 ; to Dr. S. [illegible] Registrar, Mc[illegible] of the patients and clerical assistance. The folic acid used as " folvite " was generously donated by Lederle Laboratories Division, American Cyanamid Company.

TABLE A. Summary of Observations on 23 Cases of Kwashiorkor.

Case No.	Patient	Race	Admission Date	Age in Months	Sex	Admission Hb. (g. per 100 ml.)	28th Day Hb. (g. per 100 ml.)	Bone Marrow	Serum Proteins Admission Total	Serum Proteins Admission Alb.	Serum Proteins Admission Glob.	Serum Proteins Discharge Total	Serum Proteins Discharge Alb.	Serum Proteins Discharge Glob.	Associated Infections	Hospital day of Infection	"Tervamix" given
9	B.P.	AF.	23.11.57	18	F	12.0	7.2	N	6.3	2.8	3.5	6.6	2.9	3.7	Gast. Ent.	11	
															U.R.I.	16	No
															Furunculosis	24	
10	A.M.	A.F	24.11.57	12	F	8.5	7.0	Nx2	4.4	1.7	2.7	7.2	2.9	4.3	U.R.I.	15	
															Pneumonia	18	Yes
11	T.M.	AF.	29.11.57	25	F	11.3	9.2	N	4.6	1.8	2.8	7.1	3.0	4.1	U.R.I	12	No
13	S.M.	AF.	2.12.57	16	M	9.5	6.6	N	5.0	1.4	3.6	6.8	3.0	3.8	Gast. Ent.	1	
															U.R.I.	8	No
															Stomatitis	11	
15	Z.M.	AF.	9. 1.58	24	M	10.5	10.1	N	5.8	1.8	4.0	7.2	3.2	4.0	U.R.I.	4	No
															Pneumonia	21	
16	M.T.	I.	12. 1.58	15	F	12.8	11.1	N	4.3	1.0	3.3	7.6	3.7	3.9	Nil	—	Yes
19	O.D.	AF.	21. 1.58	19	F	9.7	8.4	Mild M	3.3	1.0	2.3	7.1	2.7	4.4	Gast. Ent.	3	No
															U.R.I.	9	No
20	T.M.	AF.	21. 1.58	36	F	11.8	9.0	N	4.4	1.3	3.1	7.8	3.0	4.8	U.R.I.	11	Yes
22	B.M.	AF.	13. 2.58	25	M	10.2	8.8	N	3.6	0.9	2.7	6.4	3.1	3.3	Nil	—	Yes
23	T.G.	AF.	22. 2.58	60	F	8.9	7.5	Mild M	4.8	1.1	3.7	7.0	2.5	4.5	U.R.I.	10	No
															Pneumonia	19	
24	A.D.	AF.	24. 2.58	21	F	10.7	10.0	Mild M	3.9	1.0	2.9	6.4	2.6	3.8	Nil	—	Yes
25	N.N.	AF.	24. 2.58	16	F	10.3	9.3	N	3.0	0.7	2.3	6.0	2.4	3.6	Nil	—	No
26	D.S.	AF.	26. 2.58	20	F	7.5	10.2	N	2.8	0.6	2.2	6.0	2.6	3.4	Pneumonia	1	Yes
28	E.C.	AF.	7. 3.58	22	M	8.6	7.8	N	4.0	1.5	3.5	6.5	2.4	4.1	U.R.I.	1	Yes
32	S.K.	AF.	26. 3.58	24	M	12.0	8.2	N	4.1	1.0	3.1	6.7	2.1	4.6	U.R.I.	1	Yes
															Stomatitis	5	
33	S.N.	AF.	28. 3.58	15	M	12.0	7.6	N	4.2	1.1	3.1	6.2	2.5	3.7	U.R.I.	15	No
34	S.M.	AF.	17. 4.58	24	M	9.5	11.0	N	4.0	1.1	2.9	6.2	2.2	4.0	Nil	—	Yes
38	B.H.	AF.	5. 5.58	17	F	9.0	10.5	N	4.0	1.2	2.8	6.2	2.6	3.6	U.R.I.	1	Yes
39	Z.C.	AF.	6. 5.58	36	F	12.0	11.6	N	4.1	1.3	2.8	5.5	2.3	3.2	Nil	—	No
40	N.N.	AF.	7. 5.58	6	M	11.2	10.0	N	3.4	1.1	2.3	6.2	2.5	3.7	U.R.I.	1	Yes
41	J.M.	AF.	8. 5.58	30	M	10.1	9.8	N	4.2	1.5	2.7	7.0	2.4	4.6	U.R.I.	11	No
43	F.M.	AF.	28. 5.58	36	F	10.0	11.2	N	5.0	1.6	3.4	7.2	2.7	4.5	Nil	—	No
44	P.M.	AF.	29. 5.58	18	M	8.4	11.4	N	3.2	1.1	2.1	6.5	2.4	4.1	Stomatitis	5	Yes

AF. = African. I = Indian. N = Normoblastic Bone Marrow. M = Megaloblastic Bone Marrow. U.R.I. = Upper Respiratory Infection.
Gast. Ent. = Gastro-Enteritis.

we reported megaloblastosis in 9 per cent of all patients admitted to our wards over a period of three months (WALT, *et al*, 1957) Any studies of this disease should take into account the seasonal variations in incidence because we have shown both kwashiorkor and megaloblastosis to be more common in the summer months (WALT *et al*, 1956) Thus, in a series of 35 patients with kwashiorkor presently under investigation, 25 were seen during the summer months (November 1957 to March 1958) and of these six (25 per cent) had megaloblastosis on admission On the other hand, megaloblastosis has not been found in any of the 10 patients admitted during the autumn and winter (April, May and June 1958) When megaloblastosis is discovered on routine bone marrow examination in mildly anaemic patients, it is not usually the basis for the anaemia because treatment with folic acid causes disappearance of the megaloblasts but not of the anaemia However, when a patient with kwashiorkor is admitted in a severely anaemic state, it is almost invariably due to a megaloblastic dyshaemopoiesis which often tends to occur suddenly Such patients appear to be very ill, are exceptionally pale and usually have haemoglobin levels varying from 2 5 g to 5 g per 100 ml This "crisis" which is characterised by a drop of 3 to 4 g of Hb per 100 ml in 24 hours may occur in any patient with megaloblastosis The bone marrow is then almost entirely megaloblastic, although only occasional megaloblasts may be found in the peripheral blood Although folic acid therapy will cure the megaloblastosis within 96 hours (WALT *et al*, 1956), blood transfusion is thought to be necessary to save life

(ii) *Normocytic Normochromic Anaemia* This is the anaemia common to all our patients with kwashiorkor, including those who have recovered from megaloblastosis It is mild, the haemoglobin level varying from 7 to 10 g per 100 ml Despite adequate treatment with vitamins and high protein diets and apparent recovery from kwashiorkor, the haemoglobin level is very slow to rise It is this slow haematological response to treatment that I have been able to observe in 23 cases from November 1957 to June 1958 that I now wish to discuss (Table A)

RESPONSE TO THERAPY

All cases with tuberculosis or dysentery, and those in need of blood transfusions were eliminated from the series

Routine treatment For the first 14 days each patient is given as much lactified skimmed cow's milk as he will take, our nurses being trained to encourage and coax the patient in a kindly and patient manner Thereafter, a full ward diet is offered Potassium chloride 5 grains three times daily, procaine penicillin 300,000 units by intramuscular injection and a triple sulphonamide (90 mg per lb body weight daily) are given for the first 7 days Folic acid 7 5 mg intramuscularly daily is given routinely for 3 days after admission and thereafter 5 mg three times a day by mouth Vitamin B complex is given orally from the fourteenth day and vitamin C 50 mg daily throughout the hospital stay

Special therapy in this series Alternate patients were also given a protein supplement of "Tervamix" (Group A), a powder containing 68 per cent milk protein obtained from skimmed milk, which supplied an extra 1 g protein per lb body-weight daily Daily observations were made for a period of 28 days (Table A)

RESULTS

Haemoglobin Up to the time of writing, 36 patients have been admitted and of these 9 (25 per cent) have died Of the 27 survivors, four required blood transfusions and were therefore excluded, leaving 23 cases for analysis. Fig. 1 shows how the initial haemoglobin level, estimated on admission, was misleadingly high and how it fluctuated over 28 days. The mean haemoglobin on admission was 10.3 g. per cent. Despite resolution of clinical signs within 28 days of initiating therapy, the mean haemoglobin actually dropped, being only 9.2 g. per cent., revealing a mean difference of 1.1 g. per 100 ml. In 18 patients, the haemoglobin was still below 11 g. per cent. twenty-eight days after commencement of treatment ; nine of these had received the standard high protein diet only, while 9 had had an additional protein supplement as well. Of the 5 patients with a haemoglobin of 11 g. per cent. or more, 3 had been supplemented with protein.

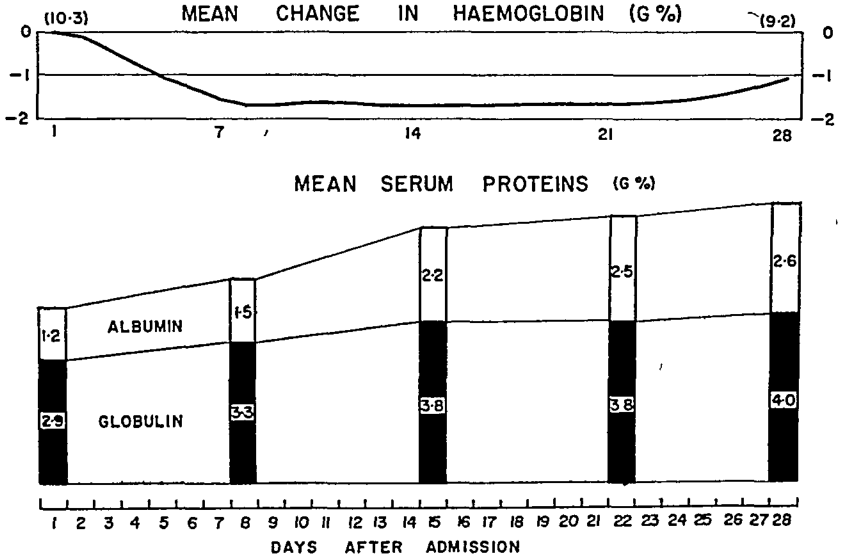

FIG. 1. The haemoglobin pattern and rise in serum proteins in 23 cases.

Serum proteins. In all cases the serum protein rose rapidly during the first two weeks of treatment from a mean of 4.1 g. per cent. to 4.8 g. per cent. after one week and then to 5.9 g. per cent. by the fourteenth day (Fig. 1). There was no significant difference between the mean serum protein levels in those cases who received supplements of protein (Group A) and those who did not (Group B).

DISCUSSION.

The results reported here once more draw attention to the presence of a mild anaemia in kwashiorkor which is very slow to respond to adequate protein-rich diets fortified with folic acid. Profound metabolic alterations undoubtedly take place during the development of the disease as well as during the period of recovery. These metabolic processes are likely to be dependent one upon the other and, although sufficient protein may be available other substances are probably also necessary for the rebuilding of tissues, the production of enzymes, the absorption and utilisation of vitamins and the mobilisation of iron, folic acid etc.

Megaloblastosis. This can be eliminated from the bone marrow very rapidly by administering folic acid. It is assumed, therefore, to be due to a specific deficiency through lack in the diet of such folic acid containing foods as green leafy vegetables, cauliflower, kidney and liver Moreover, what little folic acid is ingested is probably poorly absorbed due to associated diarrhoea Vomiting, a common symptom of kwashiorkor on admission to hospital, may also prevent adequate intake I have seen a patient in whom megaloblastosis was resolved by intramuscular folic acid, relapse three weeks later because of severe chronic constipation in spite of taking folic acid regularly by mouth

Various possibilities have been considered to explain the megaloblastic "crisis" that may occur A possible explanation is the shortening of the survival time of the red blood cells due to faulty red cell construction resulting from either a lack of haemopoietic substances or from some toxic effect upon the bone marrow resulting from infection If so it is possible that many red cells die suddenly, thus causing severe anaemia in a manner comparable to that described by Emery and Lemmon (1954) for the crises in congenital spherocytic anaemia

Haemoglobin Pattern Haemoglobin estimation is a simple and useful method of measuring anaemia but, in kwashiorkor, the initial reading is misleadingly high because of haemoconcentration Metcoff *et al* (1945) showed, in severely protein deficient rats, that there was an associated haemoconcentration and a decrease in total circulating haemoglobin because of a reduction in total blood volume We have also found marked changes in haemoglobin concentration occurring so rapidly that a change in blood volume can be the only satisfactory explanation Once the patient has had a diuresis and cure has been initiated the haemoglobin level remains fairly constant (Fig 1)

Anaemia of Infection Kwashiorkor predisposes to infection which very commonly is the reason for the patient's admission to hospital Our cases therefore are all ill and liable to spread or contract infections in the wards About 75 per cent have an acute infection at some time during their illness Many fail to respond to antibiotic therapy Virus infections occur frequently, measles being an especially dangerous disease Those with uncomplicated kwashiorkor respond quickly to treatment and, although the haemoglobin follows the expected pattern of a fall and a gradual rise thereafter, the ultimate rise is more rapid than usual and the haemoglobin may reach 11 g per cent by the end of the fourth week of treatment Many workers have stressed the significance of malaria, hookworm and helminthiasis in their patients, but these infections are not significant in our cases However, I believe that in Durban gastro-enteritis, dysentery and other acute infections are of greater importance Adams (1954) did not report the incidence of infections in his cases, while of the 9 young children studied by Woodruff (1955), eight had ascites — a very rare finding amongst our cases Josephs (1936) stated that the anaemia of infancy due to sepsis is aregenerative or hypoplastic in type Infection may depress the bone marrow in such a way as to delay the full maturation of the erythrocytes or possibly prevent the bone marrow from delivering the red cells to the blood stream. In some of our cases the development of an infection, during the period of recovery, has clearly been responsible for preventing the expected haemoglobin rise or has obviously depressed the haemoglobin level during the active phase of the infection At the same time there may be a greater demand for folic acid or its full utilisation may be prevented

Iron Deficiency Smith (1948) described the anaemia of chronic infection as normocytic, normochromic and iron deficient Iron deficiency as the cause of the anaemia of kwashiorkor has not been accepted by us in the past because of the high iron content of the maize diet of our patients and the presence of haemosiderin particles in the bone marrow Since Trowell and Simpkiss (1957) reported good responses in infants after intramuscular iron we have reconsidered our views and are, at present, investigating more fully the haemosiderin content of the bone marrow 28 days after full treatment with and without extra iron. It is unlikely that acute infections to which our patients are particularly subject, alone prevent full recovery and other abnormalities must also be considered, particularly protein synthesis, enzyme formation and other deficiencies.

Protein Deficiency Anaemia. The exact role of protein lack in the aetiology of anaemia in kwashiorkor is most difficult to assess. Some early workers (ALTMANN and MURRAY, 1948 ; ADAMS, 1954 ; TROWELL *et al.*, 1954) regarded this as a possible primary cause, while WOODRUFF (1955) appeared to prove this in his series of patients who would not respond to vitamin B12, iron or folic acid but who did improve very gradually when the diet was supplemented with casein. FOY and KONDI (1957), on the other hand, state that the type of anaemia in kwashiorkor is not due to a specific deficiency and that dietary supplements have no effect upon it unless appropriate haematinics are also given. I find the haematological response is tardy despite high protein intake together with haematinics. This may perhaps be due to the large amount of protein used for growth and recovery leaving insufficient available for the construction and full maturation of the red cells.

ASCHKENASY (1957), experimenting with rats, produced a protein deficiency anaemia which was hypochromic and microcytic in marked contrast to our patients whose anaemia is normocytic and normochromic. The bone marrows, however, in his rats were similar to those in our patients being hyperplastic and normoblastic. My difficulty is to explain the very slow rise in the haemoglobin level despite treatment with ascorbic acid, folic acid, antibiotics and high protein feeding and despite a rise of total serum protein within two weeks of initiating treatment. It is pertinent to recall that, in 1951, GILLMAN and GILLMAN wrote : " If the diet is deficient in many essential nutriments, it is impossible to dogmatise as to the specific deficiency which is responsible for a particular anaemia." *If protein deficiency alone was the principal limiting factor, a parallel rise in haemoglobin* might be expected but haemoglobin synthesis lags far behind the excellent rise in serum proteins which is achieved by the fourteenth day of treatment (Fig. 1).

Future therapy. In Durban our patients are believed to be deficient in protein and folic acid, but remain anaemic even after adequate therapy. Because kwashiorkor is a general metabolic disease, it may be impossible for the severely malnourished patient to synthesise sufficient haemoglobin during the first 28 days of treatment. In this series, however, a few of the milder cases have been able to do so. It may be asking too much of our severely malnourished infants to synthesise more haemoglobin than they do during the first four weeks of recovery ; they may be able to restore their haemoglobin completely in time even without additional haematinics. However, it is also possible that iron, cobalt, copper or some other substances may become deficient as a result of new processes initiated during convalescence and thus limit full haematological recovery. COLES (1954) reported a good res[illegible] cobalt sulphate *in* 31 *anaemic infants*, while TEVETOGLU (1956) more recentl[illegible] similar re[illegible]g a cobalt-iron mixture. Further studies along these lines u[illegible] le therape[illegible] appear to be indicated in the attempt to cure the [illegible] hiorkor [illegible]itiously.

The two [illegible] in [illegible] seen in Durban, are described. Our routine *treatment is* [illegible] 23 [illegible] anaemia in kwashiorkor *are summarised* and briefly [illegible] obin [illegible] over four weeks of treatment is shown graphically and attention is drawn to the marked delay in re establishing normal values No single factor has been discovered as the cause of the anaemia Further studies using extra iron are now in progress and it is suggested that treatment with many haematinics may ultimately be the therapy of choice

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EXCERPTS

SALMONELLA MENINGITIS

(WATSON, K C *Arch dis Childh*, **32**, 171)

Four cases of meningitis due to salmonella infections are reported in Bantu infants in Natal Two of these were due to salmonella strains not previously isolated from the cerebrospinal fluid, namely S *Johannesburg* and *S heidelberg* Salmonella infections of the meninges occur most commonly in infants in whom there is a higher death rate than in adults or older children Prognosis may depend on the type of salmonella responsible for the infection as well as the age group

TETANUS NEONATORUM A REPORT OF THIRTY-TWO CASES

(EARLE, A M and MELLON, W M *J Amer trop Med Hyg*, 1958, **7**, 315)

The management and complications of 32 cases of tetanus neonatorum seen at the Hôpital Albert Schweitzer in the Artibonite Valley of Haiti are discussed There were only 8 deaths in this series Tetanus is a preventable disease and in countries where doctors are not available for deliveries every effort should be made to train local indigenous midwives in the proper care of the newborn

A STUDY OF THE HEALTH OF A PRE-SCHOOL AGE-GROUP IN AN AFRICAN URBAN COMMUNITY

by

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In many Western countries, well-devised programmes for the promotion of child health begin at the antenatal stage and attempt to deal with nearly all phases of development up to, and inclusive of, puberty.

Even in Western countries, however, in this continuum of maturation and development, the pre-school age child has been relatively neglected, both in the knowledge of the problems faced and in the provision of appropriate health services. This statement is better illustrated in the less developed countries of the world where the orientation is directed almost totally to infant health.

The purpose of this paper is to assess the health of the 2-5 year old child in a particular community in South Africa. Problems, emerging from this type of study may possibly act as a guide to any future programme aimed at improving the health of the pre-school child.

This is an age-group with *relatively* low mortality compared with still earlier phases of development. Nevertheless, it has inherited the legacy of health problems from infancy, and is itself exposed to physical and mental hazards which can in turn perpetuate ill-health from both the earlier and present phases of development into the school-age period.

This study was undertaken at the Institute of Family and Community Health in Durban. The Institute offers a comprehensive health service to an African community, which embraces preventive, promotive and curative care at individual family group, and community levels.

In order to assess the type and magnitude of the problems faced, an attempt was made to review, what in fact, was known of the health state of this age-group in South Africa in general, and in this community in particular, with reference to growth and development, morbidity, mortality and some of the social and cultural processes that may help determine these.

(I). GROWTH STUDIES

The first study considered is that of PHILLIPS (1953). This included an assessment of the heights and weights of boys and girls attending South African nursery schools, which comprised 3 groups, namely : (1) White Upper Income group ; (2) White Lower Income group ; (3) Bantu group.

The Bantu group was living in the same urban housing scheme in which the Institute of Family and Community Health functions, and the children reported on in this article and in the present paper are members of the same community.

DR. PHILLIPS' average heights and weights have been arranged into graphs (Figs. 1a, 1b, 2a, 2b), using ½ S.D. on either side of the mean for Bantu children and the graphs indicate how the two White income groups fall relative to this growth channel.

These graphs, adapted from Phillips' figures, clearly illustrate the following points :

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*I wish to thank Mrs. K. WOLFSON for the preparation of the graphs, and Mr. W. H. PIETERSEN of the Health Records Section of the Institute of Family and Community Health, Durban, for the compilation of the statistics.

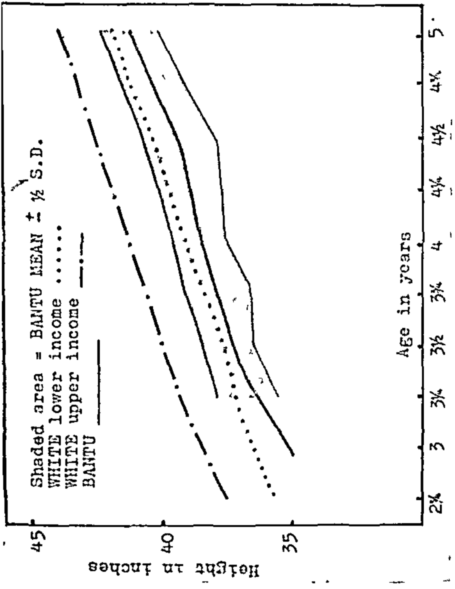

FIG. 1a. Heights of South African boys (2¾ — 5 years of age).

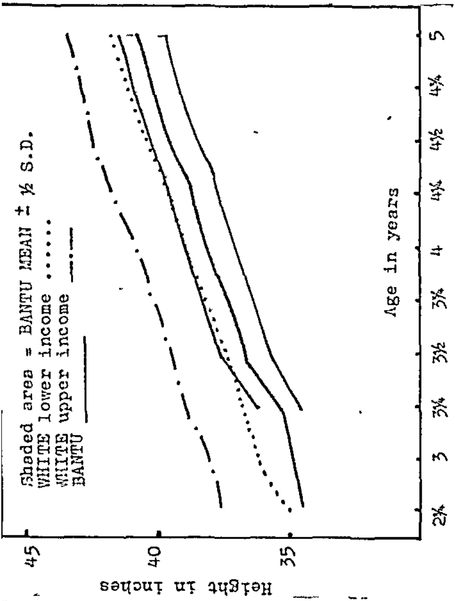

FIG. 1b. Heights of South African girls (2¾ — 5 years of age).

(i) *Heights :* (a) The Bantu height is lower than both upper White income and lower White income groups for both boys and girls. (Figs. 1a and 1b).

(b) The lower White income group and Bantu group fall within + ½ S.D. of Bantu mean for boys (Fig. 1a), but the girls of the lower White income group fall at about the upper level of + ½ S.D. (Fig. 1b).

(ii) *Weight :* The weights of the upper White income group are above those of both the lower White income group and the Bantu group for both boys (Fig. 2a), and girls (Fig 2b). This applies particularly to the boys

PHILLIPS (1953) was of the opinion that " the economic group to which a child belongs is more powerful in determining the size of the nursery school age child than the ethnic group."

This statement is borne out in his study and some of the economic factors which are undoubtedly involved are recurrent illness and malnutrition, which themselves are well-known as determinants of poor growth and development.

A second study was that of WOODROW and ROBERTSON *(1950)*, which compared the weights and heights of Cape Coloured children in the municipal area of Cape Town with the standards for English children as developed by SHELDON (1951).

This study shows differences in heights and weights of English children when compared with a lower economic group, the Cape Coloured, but these figures cannot be accurately compared with other studies as the sexes have been

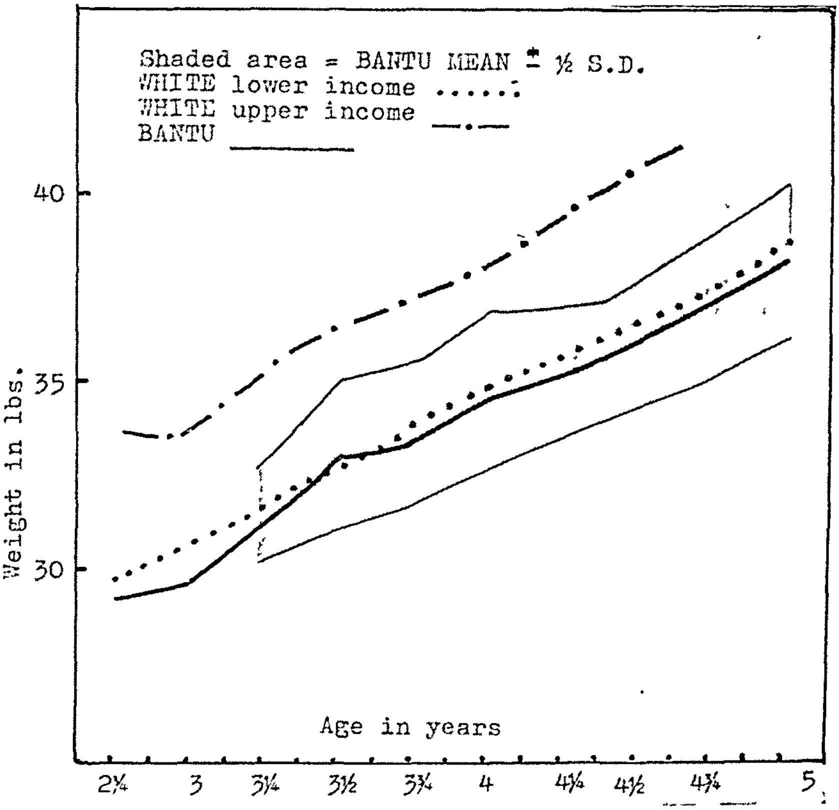

FIG 2a.
Growth curve of
South African boys
(2 — 5 years of age).

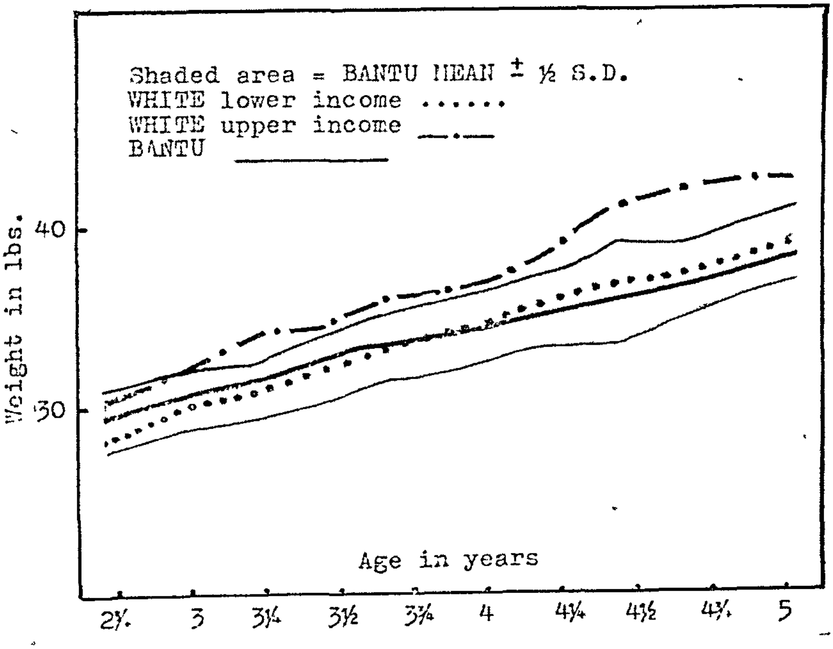

FIG. 2b.
Weights of
South African girls
(2¾ — 5 years of age).

combined in this series Nevertheless, the findings support PHILLIPS' statement

In the age group in this study, PHILLIPS points out that the Cape Coloured children are significantly lighter and shorter than their White South African counterparts and are 2-7 lbs lighter than his Bantu group, although their heights are about the same, and they are therefore of more slender build than the Bantu children

It is reasonable to surmise that should a comparison of European and Bantu groups of exactly equivalent economic status be made, differences attributable to cultural and ethnic factors may be found Whatever the reason, it is a definite fact that the growth pattern of the Bantu group is at present lower than that of the White

A grosser picture of retarded growth and development in the Bantu may be seen in the relatively common syndrome of kwashiorkor

In an address to the South African Medical Congress, WALLACE, (1957) stated " In the paediatric unit of the King Edward Hospital, comprising 160 beds, no less than 731 (African) children suffering from kwashiorkor were admitted during 1955 In 1956, the number of cases rose to 834, yet these figures must represent only a fraction of the total since there are many which never reach the wards of a hospital "

A personal communication concerning the above figures (SCRAGG, 1957), revealed that in 1955 18 6 per cent of the 731 cases, and in 1956 17 per cent of the 834 cases admitted to the hospital were over the age of 2 years

Although limited material resources play a major role in the development of this syndrome, there are other factors involved Inadequate diet may be mainly linked with inadequate income, but poor knowledge of basic dietary requirements, coupled with cultural factors that to some extent determine basic diet, must also be considered Once the infant is weaned, the constituents of his diet depends on the dietary habits of his parents Usually this diet is high in carbohydrate, and low in protein, vitamins and mineral salts

In Kampala, Uganda, growth charts of infants and children have been compared with accepted European growth charts, (BROCK and AUTRET, 1952) These weight curves *show that the maximum retardation in comparison with European standards is in the* second to fourth years and that growth has not caught up with these standards even by the fifth year of life Growth retardation is a fundamental aspect of the kwashiorkor syndrome, and the findings reflect the seriousness of malnutrition in such communities

(II) MORBIDITY STUDIES

The following investigation is an analysis of morbidity findings in African pre-school children who attended the Institute of Family and Community Health for medical care in 1954

The total known population aged between 2 and 5 years was 2,427, of which 1,193 attended the Institute However, the frequency of attendance of any one child is unknown 1,941 diagnoses were made on these children, that is 1 6 diagnoses per child (range 1-5 diagnoses with a standard deviation of 0 8)

These diagnoses represent the illness found during voluntary use of the Institute's medical care services and are indicative mainly of the felt needs of parents and other relatives about the health of their children They include, in addition, findings on children referred by pre-school centre staff and family nurses during home visits

Table I is an analysis of the diagnoses made on children who attended the Institute for medical care , while Table II gives a more detailed analysis of these diagnoses

The classification is based on epidemiological lines and the grouping, it is hoped, facilitates an understanding of the major types of disease in this community.

Methods of control determine the headings under which illnesses are placed. Certain diseases, such as whooping cough and typhoid, could be classified under more than one heading. For example, in the case of whooping cough, it is more convenient to classify the condition under " Diseases preventable mainly by immunisation " ; whereas typhoid is better classified under " Faecal-borne " in preference to the " Preventable mainly by immunisation " group.

These diagnoses were made on children brought for curative care, and do not include children seen at periodic health examinations, where tuberculin testing, immunisation procedures and laboratory investigations are carried out. Nevertheless, these diagnoses do give a working basis for assessing disease problems experienced.

It is necessary, however, to point out omissions from the table of diagnoses of other morbidity groups which are, in fact, thought to be present in this community.

(1). *Orthopaedic and Postural Defects.* A survey of 50 children attending a pre-school centre conducted by the author revealed that 76 per cent had " poor " posture, 22 per cent were classified as " fair " and only 2 per cent could be assessed as " good. " The method was purely a subjective one, and no photographs were taken using the grid technique.

TABLE I. Analysis of the Diagnoses made on Children who attended the Institute for Medical Care.

	No. of diagnoses	% of diagnoses for each disease group	% of 1,193 children-diagnosed
(A) INFECTIOUS (1) Physical contact infection	276	14 2	23.2
(2) Airborne infection	913	47.0	76.4
(3) Faecal-borne infection	397	20.4	33.5
(4) Urinary-borne infection	3	0.2	0.3
(5) Preventable mainly by immunisation	8	0.4	0.7
(B) Nutritional	209	10.8	17.5
(C) Oral	34	1.8	2.9
(D) Allergy	35	1.8	2.9
(E) Accidents	66	3.4	5.6
TOTAL	1941	100 0	

" Poor " posture was composed in varying degrees of rounded shoulders, winged scapulae, lordosis, protuberant abdomens, genu valgum, pes planus and " general fatigue posture."

Debility resulting from recurrent illness and poor nutrition are factors that must be considered in the appraisal of this type of posture. However, it is difficult to distinguish clinically, the degrees or combinations of postural defects that can be regarded as abnormal at this stage of growth and development.

(2) *Emotional and Behaviour Problems* A parent in this community seldom brings a child with an emotional disturbance or a behaviour problem, as the presenting complaint

The cultural group itself may have less rigid standards of conformity The parental

TABLE II A More Detailed Analysis of the Disease Groups in Table I

	No of diagnoses	% of diagnoses for each Disease group	As % of 1,193 Children diagnosed
A INFECTIOUS			
1 *Physical Contact infection*			
Scabies	62	22 5	5 2
Impetigo	142	51 4	11 9
Otitis externa	3	1 1	0 3
Ringworm	23	8 3	1 9
Conjunctivitis	41	14 9	3 4
Blepharitis	2	0 7	0 2
Styes	3	1 1	0 3
Total	276	100 0	23 2
2 *Airborne infection*			
(*a*) *Acute infections*			
Measles	71	7 8	5 9
German Measles	1	1	0 1
Chickenpox	12	1 3	1 0
Mumps	4	4	0 3
(*b*) *Other Respiratory*			
U R I	403	44 1	33 8
Nasopharyngitis	67	7 3	5 6
Otitis Media	94	10 4	7 9
Tonsillitis/Pharyngitis	76	8 3	6 4
Bronchitis	79	8 7	6 6
Pneumonia	51	5 6	4 2
Influenza	3	0 3	0 3
Tuberculosis			
Active Disease	1	0 1	0 1
+ve tuberculin reactions	51	5 6	4 2
Total	913	100 0	76 4

TABLE. II. *Continued.*

	No. of diagnoses	% of diagnoses for each disease group	As % of 1,193 children diagnosed
3. *Faecal-borne Infection*			
(a) *Bacterial*			
Bacillary dysentery.	2	0 5	0.2
Enteritis.	41	10.3	3.4
Gastro-enteritis	139	35.0	11.6
(*b*) *Parasitic*			
Amoebic Dysentery	8	2.0	0.7
Ascariasis.	200	50.4	16 7
Ankylostomiasis.	4	1.0	0.3
Taeniasis.	3	0 8	0 3
Total	397	100.0	33.2
4. *Urinary-borne Infection :*			
S. haematobium.	3	0.2	0.3
5. *Preventable mainly by immunization*			
Whooping cough.	7	87.5	0.6
Diphtheria.	1	12.5	0.1
Total	8	100.0	0.7
B. NUTRITIONAL	209	10.6	17.5
C. ORAL DISEASES			
Dental caries.	15	44.1	1.2
Gingivitis.	5	14.7	0.4
Thrush.	14	41.2	1.1
Total	34	100.0	2.7
D. ALLERGIC CONDITIONS			
Asthma.	4	11.4	0.3
Other allergies.	31	88.6	2.6
Total	35	100.0	2.9
E. ACCIDENTS			
Burns.	35	53.0	2.9
All wounds.	27	41.0	2.3
Fractures.	2	3.0	0.2
Poisoning.	2	3.0	0.2
Total	66	100.0	5.6

attitudes towards enuresis, soiling, undue submissiveness or aggression may be of such a nature that medical advice or therapy is not considered necessary

Another factor that may be involved is the cross cultural one of the physician belonging to one ethnic group and the patient to another, so that possibly psychological symptoms and signs might therefore not be presented or discussed The therapeutic use of witchdoctors may be suspected for this type of illness, although this is reputed to be uncommon At the 2-5 year age level, even in a more stably settled community one would expect a number of children to express symptoms of social maladjustment and/or behaviour disturbances It will become clearer later in this paper that the abnormal family life situations in this community are such as would be expected to lead to emotional and behaviour problems well before adolescence

The social environment of the pre-school age child is made up of his family, his neighbourhood play-groups, the pre-school centre, should he attend one, and the community Social participation in these aspects of his environment is necessary for his mental maturation and development

The pre-school age period is, as BOSSARD notes, a "major social process in child development, precipitating what is for many life's first major social crisis " It is a period, like others, of interaction between himself and his family, but differs in that he has now to adjust to other children and adults who are not part of his family but of his broadening social horizon

The pre-school child moves for the first time away from the more intimate dependent relationships within his family life situation to the neighbourhood groups, which may consist of play groups in the streets, in other homes, or at more disciplined pre school centres

In the play groups, the child will have to adjust to other children with little formal guidance, and personality development will be put to the test The child may emerge a leader in these social situations or become the object of taunting, bullying, or even active isolation by the group In the pre-school centre itself, the ideas and disciplines experienced are often quite different from those within his family unit

The child may emerge from these interactive processes more confident and mature, and with potentialities that are given the opportunity for fuller development, or he may become profoundly disturbed Thus, there may emerge eating or sleeping problems, relapses in his toilet training, such as enuresis, soiling, or other less tangible disturbances which could have a profound effect both on his mental and physical health It is, therefore, surprising that these diagnoses are absent from the present classification

With regard to diagnoses made on these children in Table I, the portmanteau heading " Infectious group, comprising physical contact, air-borne, faecal and urinary borne and diseases preventable mainly by immunisation " makes up 1,547 (82 2 per cent) of the total 1,941 diagnoses

Further comments on some of the diagnoses will follow and in the discussion of social and cultural factors in this community, an attempt will be made to indicate any relationships between these factors and the disease groups shown in the table

Prior to discussing the social and cultural processes that determine departures from optimal health in this community, it is necessary to study the incidence of the " final departure " by discussing mortality figures

(III). MORTALITY STUDY

There are difficulties in obtaining accurate mortality figures for this age-group. The reports of local authorities are not normally classified into deaths occurring in the 2-5 year old group, and when they are, the figures are often classified into European (White) and " others or non-European. " The different non-White ethnic groups are not differentiated so that, for example, the figures for African children alone are not revealed.

The authorities are also faced with the problem that, in African populations particularly, mobility in and out of the areas makes the compilation of accurate census figures very difficult.

The Institute figures for this age-group for the years 1953-1957 showed a total of 47 deaths (20 male, 27 female) — a mortality rate of 5.36/1000. 36.2 per cent of deaths, or 17 out of 47, are classified as of unknown etiology. These children all died in rural areas and the causes of death could not be ascertained. Tuberculosis (12 deaths) pneumonia (9 deaths) and gastro-enteritis (6 deaths) appear as the major causes in this small series and together represent 63.9 per cent of the Institute's classified deaths. There are few who would quarrel with the fact that these deaths are often associated with underlying malnutrition, although only 3 deaths were considered to be due primarily to malnutrition.

The population of Langa township in the Cape, although of a different ethnic group to the Institute community, lives in a municipal housing scheme similar to that of the community that the Institute serves. Although the number of deaths in 1954 was only nine, 8 of these died from tuberculosis, pneumonia or gastro-enteritis.

WALLACE'S (1957), deaths in his analysis of kwashiorkor cases were as follows :— Of the 731 kwashiorkor patients admitted during 1955, 393 (54 per cent) died from the disease and its complications. In 1956, of the 834 kwashiorkor patients who were admitted there were 432 (51.8 per cent) deaths from the disease and its complications. Malnutrition is a contributing factor in all the mortality figures discussed.

DISCUSSION

Social and Cultural Processes as Determinants of Health. An indication of the health of pre-school age children has been partly shown by a consideration of growth and development, the analysis of morbidity and mortality with special reference to a particular community. The social and cultural factors operating in this community are now discussed in terms of processes which may determine this departure from health and help to explain some of the findings.

The African pre-school age children in this study, who are predominantly Zulu, live in a municipal housing scheme on the southern outskirts of Durban. The community to which they belong enjoys the advantages of relatively well-constructed brick and iron housing, waterborne sewage, a municipal water supply and refuse disposal system, and storm water drainage. In addition, there is the availability, within the limited material resources at the disposal of its members, of pasteurised milk supplies, fresh meat, fruit and vegetables. The physical aspects of this environment may be conducive to the promotion of better standards of health, but social and cultural factors are also determinants which have a profound effect on the health practices and health state of the community, both in the spread of disease, and in the action taken in matters of health.

The social structure of this community is made up of varying types of family composition and patterns of living, of ways of neighbourhood and community life, of socio-economic status and social stratification, and of degrees of social security, educational and religious values, to mention but part of the complex. Cultural factors influence and affect all these components. Culture can be defined as learned behaviour and is subject to alteration and modification by educational means.

In this particular community, traditional beliefs, habits and customs may be firmly rooted, and change may occur slowly. Nevertheless, closer association with Western living in general and urban living in particular, has brought some change, and with it the adaptations and adjustments that have to be made.

The children in this community constitute the first predominantly urban-born generation. " In 1950, a survey in this community showed that 90 per cent of the men and women were born in predominantly rural areas, whereas 75.3 per cent of the children under the age of 16 were born in Durban. "

The significance of this demographic fact is that rural ties are strong and there is a constant movement of people to and from both urban and rural areas, and, with this movement, the subsequent spread of disease (KARK, 1957). This practice further increases the crowding in the urban homes and brings into close contact people with relatively poor knowledge of personal and environmental hygiene, and undermines health education programmes aimed at producing better health habits, in addition to subjecting these visitors to diseases to which they may have developed little, if any, immunity.

The physical-contact disease group is an example of how overcrowding, poor health knowledge and unhygienic habits are factors facilitating spread. Despite good sanitary facilities, health education is essential to change the sanitary habits and practices of a community. Indiscriminate defaecation, the acceptance of insanitary habits, unclean toilets and scattered refuse are some of the problems to be tackled by these educational means.

Some indication of the mobility of this population is shown by an Instititue study (KARK, 1957a.), directed by Dr. J. CHESLER of the Institute staff. In 1940, the average number of persons per home in the area studied was 5.8 (in 682 homes), but in measuring the migration of people through these homes, it was found that the average number passing through and remaining for periods varying from 4-24 months was 11.7. A large number of these people have come from rural areas because they were unwell and in need of medical care. Therefore illness is brought directly into these homes and, as crowding is further increased, the spread of communicable disease is aggravated.

The relatively high figures of air-borne infection in this age-group are not surprising and probably do not differ markedly from those in other parts of the world. The constant movement of susceptible children does little to control the spread of this type of disease. Active tuberculosis is surprisingly low in a community where behaviour conducive to the spread of the disease is so prevalent and underlying malnutrition affords such a favourable nidus for infection.

Material resources in this community are limited and this has a number of implications for health. The occupational class of the breadwinners is an important factor in determining this inadequacy. An Institute study of 663 gainfully employed persons in 401 homes revealed that 80.5 per cent were engaged in predominantly manuel work of which 67.7 per cent was unskilled. The average wages earned varied from £2 to £2. 10. 0 per week, so that this necessitated other family members, especially mothers, going out to work to supplement the limited family income.

While limitation of material resources does to a great extent determine both the quantity and quality of the diet, the type of food consumed is partly dictated by custom and by poor knowledge of important foods necessary for the promotion of health.

Mainly carbohydrate foods form the bulk of the diet, and, whatever the income, the basic pattern consists of mealie meal, (maize), mealie rice and *putu*, (thick mealie meal porridge with salt), and such vegetables as potatoes, with variable usually totally inadequate, additions of green vegetables, milk, fish, meat or fruit. In consequence a careful assessment of nutritional signs reveals many children who can be diagnosed as suffering from inadequate nutrition, so that the preventive and promotive roles played by physician, nurses and health educators in dietary advice and guidance is plainly of vital importance.

The necessity for the mother to work deprives infants and young children of parental care and supervision. Breast-feeding may decrease in frequency or cease totally. This early cessation has both emotional and nutritional health implications, (KARK, 1957b.)

The lack of supervision of children resulting from the parents' absence from home when both are working is often responsible for accidents, of which burns constitute a major proportion. A number of children remain ill for many days before the illness becomes severe enough to be noticed and it is also difficult for advantage to be taken of immunisation procedures, or the advice that could be obtained by regular attendance at mother and baby clinics.

Again rapid urbanisation of the African has loosened family ties and increased the traditional practice of shifting responsibility for child care on to grandmothers, other relatives or even girls of 8-10 years of age who accept almost complete responsibility for the younger sibling's care and upbringing. Illegitimacy is rife, and abnormal family life situations numerous. Large numbers of children have undergone the experience of frequent moves to relatives in rural areas for varying periods of time and this practice is often forced by economic necessity.

An Institute study, (KARK, 1957a.), under the direction of Dr. B. GAMPEL, Senior Family Physician of the Institute and Senior Lecturer of the Department of Social, Preventive and Family Medicine, University of Natal, revealed that in a random-sample of 148 families, where 300 children's family life situations were studied, 138 children were not living with both parents and no fewer than 58 were below the age of 5. 52 of the 138 were born to unmarried mothers. With this form of deprivation, social maladjustment and behaviour problems are probably present, and as has been said previously, should emerge.

The beliefs about disease, and the behaviour of a community with regard to it, is culturally determined. This in no way implies that in all cases a particular ethnic group would think and behave in a similar fashion about any particular illness.

The other determinant is differences in health knowledge which exist within the same community. The industrial urban African has heard about tuberculosis, and some may even know the signs and symptoms sufficiently well to ask for an X-ray of the chest to confirm or exclude his suspicions.

The rural African may believe that he is bewitched by some member of his community and complains of "*isofuba idliso*". This disease is believed to be caused by bewitched food or liquid which has become lodged in the chest and gives rise to cough, loss of weight and the spitting of blood. The *inyanga* or witchdoctor is then consulted and the treatment given is *ukuphalaza* or the "vomiting out" of the bewitched food before the patient can recover.

In infancy similar cultural differences may be illustrated by using gastro-enteritis as an example. However, before doing so, it is important to stress that different Europeans may have varied beliefs and behave in many different ways, depending both on their values and framework of knowledge in the same way as may the African or Indian patient Nevertheless, the "classical beliefs and behaviour patterns" in these 3 ethnic groups may be used to illustrate what action is usually taken with regard to the same illness

The European mother whose infant contracts gastro enteritis may sometimes believe her breast-milk to be inadequate in quantity or quality, and her anxiety does little to diminish this conviction Her doctor, the infant welfare centre, the pharmacist, herbalist and well-meaning relatives and friends are consulted in turn She thus obtains a welter of conflicting information and a numerous variety of artificial foods, both of which simply serve to throw herself as well as her baby's digestive system into confusion

The Indian mother may consult a Brahmin priest because celestial forces are often thought to be responsible for the malady, yet some guilt factor appears to be recognised by the mother as she herself undergoes a purification ceremony, in order that her infant may become well

The African mother may consult the *inyanga* as her belief is that her breast milk is bewitched The illness is diagnosed as *inyoni** and the traditional treatment is the administration of enemata

The important point is, there is in each of these cultural groups a failure of the maternal role with regard to the feeding of the infant Nevertheless the mother projects the blame for the illness respectively on to food, celestial forces, and bewitchment It is therefore, essential to bear these facts in mind when considering a patient's illness, so that therapy can become really effective

As in infancy, so in the child's later development, cultural beliefs, attitudes and behaviour are aspects of rearing that cannot and must not be ignored

SUMMARY

This article has indicated some of the disease problems in the pre-school age group in a particular community, and has discussed briefly some possible social and cultural factors that may be involved Any health programme, in whatever community it is applied, must consider the health implications of these factors, and develop suitable health educational techniques, in addition to the preventive or traditional curative methods

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**Inyoni* literally translated from the Zulu language means "bird" It is believed that this particular bird travels down with lightning directed by some ill-wisher and remains alive under the ground where the lightning has struck Pregnant women in particular who pass this spot become bewitched They may then have miscarriages, stillbirths or their infants are born susceptible to various illnesses, among which are the various forms of diarrhoea

RHESUS SENSITIZATION IN KENYA AFRICANS

by

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Erythroblastosis foetalis is recognised infrequently in Africans, and, in view of the fact that no cases have been reported previously from Kenya, it is felt that three instances of rhesus sensitization which have been encountered in Nairobi in the past year are worthy of note.

ZOUTENDYK (1947) was the first to record rhesus sensitization in Africans when he described three cases in South African Bantu. He commented on the fact that although the condition was uncommon, it was probably not as rare as had commonly been accepted. Nevertheless, a search through the literature fails to reveal any recorded cases from the whole of Central Africa, West Africa and the Belgian African territories.

Two neonates with icterus gravis, one with proved kernicterus at autopsy, have been reported from Uganda (RAPER and CHERRY, 1949). Unfortunately, it was not possible to obtain haematological proof in these cases. In the first of these, the diagnosis depended on history alone, and in the second on kernicterus—a finding which is no longer considered to be pathognomonic of rhesus sensitization (BLACK-SCHAFFER et al., 1954 ; AIDIN et al., 1950).

CASE REPORTS

Case 1. An 8 day old female Kikuyu infant weighing 5 lbs. 6 ozs. was admitted to King George VI Hospital, Nairobi, on 8/8/58, for investigation of progressively deepening jaundice which had first been noticed 3 days after birth. She was the 11th child of a monogamous marriage, and the family history was as follows :

1st pregnancy	Stillbirth at home—cause unknown.
2nd pregnancy	Child alive and well.
3rd pregnancy	Child died at 8 years after tonsillectomy. Healthy in infancy.
4th pregnancy	Child alive and well.
5th pregnancy	Child alive and well.
6th pregnancy	Baby jaundiced at birth. Treated in another hospital for 3 weeks, now alive and well.
7th pregnancy	Baby jaundiced at birth and died 2 days later.
8th pregnancy	Child alive and well.
9th pregnancy	Child alive and well.
10th pregnancy	Stillbirth.
11th pregnancy	Baby jaundiced on the third day.

The baby was deeply jaundiced and severely anaemic on admission. Both liver and spleen were enlarged, and there was oedema of the face and legs.

The haemoglobin was 4.4 g./100 ml. The direct Coombs' test was negative but this result is open to doubt, having been undertaken at night as an emergency measure without adequate controls or supervision. The occurrence of a negative Coombs' test in association with erythroblastosis foetalis is, however, known to occur (VAUGHAN, 1946 ; DACIE, 1956). The baby's blood group was 0 rhesus positive (D positive) and the mother's was group A rhesus negative with a probable rhesus genotype Cde/cde. Antibodies were demonstrated in the mother's serum, using D positive cells, to a titre of 1 in 64 in saline and 1 in 256 in albumen An indirect Coombs' test using the mother's serum and the baby's cells was positive The mother's Kahn test was negative

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The age of the baby and the lack of proper exchange transfusion equipment raised several technical difficulties regarding treatment, but a partial exchange was eventually accomplished by giving Group 0 rhesus negative blood into the right saphenous vein at the ankle and withdrawing 10 20 ml of blood from the right jugular vein at 15 minute intervals In this way, 200 ml blood was administered, but it was only possible to withdraw 75 ml

On the following morning, the haemoglobin was 15 5 g /100 ml , reticulocytes were 16 per cent and nucleated red cells in the peripheral smear numbered 92/100 w b c The platelet count was 12,000 per c mm A direct Coombs' test at this stage was doubtfully positive, interpretation being difficult owing to the high proportion of transfused cells

Treatment with vitamin K and prophylactic penicillin was started, but there was persistent capillary oozing from injection sites and by 18/8/58, the haemoglobin had fallen to 5 8 g /100 ml A further transfusion of 150 ml was given and the haemoglobin rose to 9 2 g /100 ml Unfortunately refrigerated blood had to be used as no fresh blood was available The child's capillary oozing persisted, jaundice remained unchanged and both liver and spleen were becoming larger

Eventually on 23/8/58, fresh group 0 rhesus negative blood was obtained and a further transfusion of 150 ml was given Capillary oozing thereafter ceased, the haemolgobin rose to 13 6 g /100 ml and the child's general condition improved considerably

During the period 5/9/58 to 25/9/58, the haemoglobin fluctuated between 9 8 and 8 5 g /100 ml , the platelet count remained below 85,000 cm , a temporary eosinophilia of 13 per cent developed, and nucleated red cells gradually disappeared from the peripheral blood

Jaundice eventually disappeared completely on 24/9/58, but there was no decrease in the size of liver or spleen The child was gaining weight steadily and showed no clinical evidence of residual cerebral damage

When seen at the outpatient clinic on 6/11/58, she had gained 1 lb in weight, her haemoglobin was 9 1 g /100 ml and both liver and spleen, although still palpable, were much smaller The mother's serum was tested again and showed a falling titre of antibodies with saline at 1/32 and albumen 1/128 using the same test cells as before

Case 2 A Mkamba woman came to the African Maternity Hospital, Nairobi, in October, 1957 She gave the following history

1st pregnancy	Child alive and well, no jaundice at birth
2nd pregnancy	Baby died at one week of age with severe jaundice
3rd pregnancy	28 weeks advanced

Blood tests showed her to be Group 0 rhesus negative (Cde/cde) The indirect Coombs test was positive using D positive test cells Albumen antibodies were present to a titre of 1/2, but saline antibodies were not detected Tests repeated at 32 weeks' gestation gave the same antibody titre

Labour was induced at about 38 weeks, and a live female child, weighing 7½ lbs was delivered The infant's general condition was good and there was no obvious jaundice at birth Examination of the direct cord blood gave a positive direct Coombs' test, a haemoglobin of 12 5 g /100 ml and a serum bilirubin of 2 7 mgm per cent

An exchange transfusion was carried out about 3 hours after birth, 460 c c of blood being exchanged via the umbilical vein The child was somewhat jaundiced the following day, this deepened rapidly and a bilirubin estimation on the 3rd day had reached the alarming figure of 48 mgm per cent , the haemoglobin being 16 5 g /100 ml When the results of these tests became known, a second exchange transfusion was immediately undertaken In spite of this treatment, signs of cerebral irritation became apparent, there was vomiting and increased muscle tone, and there seemed little doubt that the baby was developing kernicterus However, she improved steadily and by the eleventh day was taking the breast well, her haemoglobin was 15 g /100 ml and she was allowed to leave hospital

She was seen from time to time up to the age of seven months There was never any clinical evidence of anaemia, mentally she developed well but the muscles of her neck were hypotonic and her limbs remained spastic

Case 3 A young Kikuyu woman of about 25 years of age was referred to hospital for advice regarding subsequent pregnancies, as she gave a history of having lost two babies within 7-10 days of birth, both of whom were severely jaundiced The last baby had been born on 22/6/58, and she had no living children There was no history of stillbirths or abortions, and she was not pregnant at the time of examination on 25/9/58

The patient's blood group was 0 rhesus negative (Cde/cde) and that of her husband was group 0 rhesus positive with a probable genotype CDe/cDE An indirect Coombs' test on the patient, using her husband for test cells, was positive Albumen antibodies were present to a titre of 1/4, but saline antibodies were not detected The Kahn test was negative

DISCUSSION

Although the number of jaundiced babies admitted to King George VI Hospital, Nairobi, in the neonatal period is small, the cause of the jaundice in the majority of cases has previously been due to sepsis or congenital syphilis, with an occasional case of congenital obliteration of the bile ducts.

In only one of the present cases (Case 1) was it the baby who was referred to hospital for treatment. In Cases 2 and 3, it was the mother's obstetric history which led to the investigation and detection of rhesus sensitization. The family history in Case 1 was less typical, but it may have been due to the father being heterozygous. Unfortunately, he lived far from Nairobi, and was unable to come to hospital for examination.

The mother in each of these cases was found to be rhesus negative and the antibody was found to react with rhesus positive cells. (The terms positive and negative being used in reference to the D gene). A single test of this type does not, of course, provide proof of the identity of the antibody, particularly in the absence of a full genotyping of the test cells, but the assumption is very strong that anti-D is involved.

PICKLES (1949) has stated that " Anti-D alone or in combination with other antibodies is found in the maternal serum in over 98 per cent. of cases of haemolytic disease of the newborn." Since then, new antibodies have been discovered, but there is no evidence to suggest that this figure is other than valid. It can, therefore, be assumed that in these cases we were dealing with anti-D either with or without other antibodies.

The finding of these cases raises the interesting question as to why haemolytic disease of the newborn has not been seen in East Africa in the past. Have the cases been missed, or are they extremely rare ? There is much in the older literature on African medicine suggesting that this or the other disease does not occur in Africans ; statements which are later disproved when it is found that non-occurrence has been merely non-recognition. The literature on sickle cell anaemia illustrates this very well. Originally thought to be very rare, it is now generally accepted that it occurs with the frequency expected by genetic theory. Haemolytic disease of the newborn could well be missed in African maternity units, jaundice and anaemia being less striking in a black than a white skin. It is possible also that the practice of discharging patients from maternity hospitals on the 3rd or 4th day, or earlier, might account for some cases escaping recognition. ARMATTOE et al. (1953) from West Africa subscribe to this view, stating that " In those centres where detailed study and treatment of newborn infants and pregnant women are possible it will probably be found that haemolytic disease of the newborn due to maternal immunisation by the Rh. factor does occur . . ."

It is perhaps a sound principle in African medicine that expectation of disease incidence should be based on generally established principles ; at least until the accumulation of facts can prove otherwise. It is possible from the available knowledge on blood groups in East Africa, and working on principles established in Europe to make a theoretical assessment of the possible incidence of haemolytic disease of the newborn due to rhesus groups in East Africa, which can then be used as a basis for further investigation.

Published information is available on the blood groups of the Jaluo and Kikuyu tribes of Kenya, the Bahima of Uganda, the Iraqw of Tanganyika and the Bahutu and Batutsi of Ruanda-Urundi. The expected rhesus negative incidence in 128 Jaluo was found to be 1.8 per cent. and in 124 Kikuyu was 2.5 per cent. In blood samples from a mixed group of 172 Jaluo and Kikuyu, the expected incidence was 5.4 per cent. (ALLISON et al , 1952). In 117 Bahima, the calculated expected incidence of rhesus negative individuals was 7 7 per cent and of 93 Iraqw 4 35 per cent (ALLISON et al , 1954) In 127 Batutsi, the expected incidence was 5 8 per cent , and in 267 Bahutu 4 5 per cent (HUBINONT et al , 1953) The range of these figures lies between about 2 per cent and 8 per cent , with the Bahima at the upper end of the range In a series of 1,115 African bloods tested in the blood bank in Nairobi, 5 2 per cent were recorded as rhesus negative by Chown's test Some of these will have been D^u, which was not tested for, leaving a true rhesus negative incidence of approximately 3 5 per cent In a small group of 64 Baganda, 61 were found to be rhesus positive and the remaining 3 to be D^u The true rhesus negative rate for this tribe must therefore lie somewhere between 0 and 5 per cent (JACOB, unpublished data) MOURANT (1954), states that relative uniformity of distribution of the rhesus blood groups is a characteristic of the tribes south of the Sahara, the Bahima being a possible minor exception This being so, and in view of known published figures, it seems a fair assumption that the mixture of tribes seen in East African hospitals will have a rhesus negative rate of approximately 4 per cent with the possible exception of the Hamites, who may have a somewhat higher rate than this

There is considerable evidence from Europe and America that in the absence of sensitization by transfusion, far fewer rhesus negative mothers develop antibodies than would be expected from the blood groups of their babies The mechanism of protection is not understood nor why it breaks down in some instances, though it is certain that where the husband and wife are ABO compatible (i e , the husband could give a transfusion to the wife) sensitization is more likely to occur RACE and SANGER (1954), quoting work of HARTMANN in Norway, state that sensitization can be expected to occur in 1 in 10 pregnancies with the necessary rhesus conditions If we assume the mechanism of sensitization to be the same and as frequent in Africans, and knowing that the ABO groups are such that the frequency of compatible marriages is unlikely to be very different from Europe, we can calculate the expected incidence of haemolytic disease of the newborn In fact by far the majority of African marriages do provide the necessary conditions for sensitization in that the low rate of rhesus negative makes a rhesus negative, rhesus negative marriage a fairly rare event, and since the heterozygous Dd rate is also very low in Africans it must be very unusual for a rhesus negative woman to carry a rhesus negative foetus Therefore, approximately 1 in 10 of rhesus negative women may be expected to develop antibodies, that is to say 0 4 per cent of all women In terms of births the incidence of haemolytic disease of the newborn will be slightly less than this allowing for the unsensitized first baby, say 0 3 per cent The usual figure quoted for England is 0 5 per cent of all births (WALKER and MOLLISON, 1957 , WALKER and MURRAY, 1958) That a population of 4 per cent rhesus negative should give an expected incidence of haemolytic disease at about 0 3 per cent of all births compared with an observed rate of 0 5 per cent in a population of about 15 per cent rhesus negative seems a rather startling conclusion The relatively higher expected incidence in Africa is due to the fact that the rhesus negative African woman has a far greater chance of bearing a rhesus positive child than does her European counterpart

This figure of 0 3 per cent of all births was arrived at on the assumption that sensitization in African women occurred as frequently as in Europeans, given the necessary conditions This may or may not be so SCOTT et al (1951) reported 5 cases of haemolytic disease in American negroes of which 4 were due to ABO incompatibility and only one to rhesus sensitization These occurred in a total of 11,217 births an incidence of 0 045 per cent for all cases and only approximately 0 01 per cent for rhesus sensitization This is a far lower incidence than the possible figure of 0.3 per cent. arrived at by calculation.

It seems clear therefore that routine rhesus testing of African women should no longer be avoided. If the incidence of haemolytic disease of the newborn due to rhesus sensitization lies anywhere near the calculated figure, then it becomes an important part of health service provisions. If, on the other hand, the incidence is far lower, as the American figures suggest it might be, then it is of considerable importance to establish this fact. If rhesus negative Africans are relatively more often protected from sensitization by a rhesus positive foetus than are Europeans, then some clue might be provided as to the mechanism of the protection. Meanwhile, it seems wise to assume that rhesus sensitization occurs at the expected frequency until the provision of definite proof to the contrary.

SUMMARY

Three cases of rhesus sensitization in Africans in Nairobi are described. The reasons for the apparent rarity of this condition are discussed, and the necessity for further investigation is stressed.

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NITROGEN, CALCIUM AND PHOSPHORUS BALANCES OF THE NURSING AFRICAN MOTHER

(EVALUATION OF THE MINIMAL DAILY REQUIREMENTS)

by

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Nursing would seem to be an important nutritional strain for the African mother, as during gestation she does not interrupt working in the fields and breast feeding is prolonged for 2-3 years Analysis of the milk of African women of Kwango has given important details of its composition, and, above all, showed its small volume with a practically normal composition of proteins, fats and minerals (Holemans, Labrechts and Martin, 1954a, 1954b , Holemans and Martin, 1955)

Our present aim is to show the consequences of breast feeding on nitrogen, calcium and phosphorus balances of these African mothers and to establish the minimum requirement of each of these The women lived in their usual environment where they normally consume a diet low in nitrogen and minerals

Methods

Five Basuku women of the Feshi Territory of Kwango, in the Belgian Congo were studied They were nursing babies from 8 to 24 months Their average weight was 43 kg The balance experiments were carried on for a period of ten days

The usual customary diet was kept unchanged and was given *ad libitum* It consisted mainly of cassava paste, enriched during the experiment with dried fish This diet supplies the subjects daily with approximately 50 calories/kg , 150 mg /kg of nitrogen, 10 mg /kg of calcium, 15 mg /kg of phosphorus Faeces and urine were collected during the 10 day period and analysed along with the food for N Ca and P according to the same classic techniques outlined in a previous communication (Holemans Lambrechts and Martin, 1955) Several ml of breast milk were taken for analysis during the course of the experiment A small amount of Ca^{45} was given in the food in order to study the endogenous faecal calcium These results will be published elsewhere (Lambrechts, Holemans and Hubin In press)

Results

It is not practicable to give the detailed results of the daily balance determinations Table I outlines the average figures for N, Ca and P obtained during the experiment The milk secretion is not considered in Table I , and for this reason, we use the term "gross retention," as "net retention" represents the total net balance — food minus (faeces + urine + milk) of each subject for the different substances under consideration

(i) *Nitrogen* The average nitrogen intake was 153 6 mg /kg /24 hours or 41 1 g of protein, almost 1 g /kg /24 hours This quantity is superior to the protein content of the usual village diet that we have previously reported as about ± 25 g of total protein per day (Lambrechts, Holemans and Rots, 1956) This amount of protein gives a definite positive balance which is identical with the retention observed in malnutrition and kwashiorkor cases studied by us in 26 children and 3 adults (Holemans, Lambrechts and Martin, 1955) Therefore, the minimum requirement, corresponding to a zero retention must be less than 150 mg /kg /24 hours

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TABLE I. Results of nitrogen, calcium and phosphorus balances on five nursing African mothers.

Case	Weight (kg.)	Age Child (months)	Nitrogen. Intake (mg./kg. /24h.)	Nitrogen. Excretion mg/dy. faeces	Nitrogen. Excretion mg/dy. urine	Nitrogen. Gross Retent (mg./kg./ 24h.)	Calcium. Intake (mg./kg. /24h.)	Calcium. Excretion mg./24h. faeces	Calcium. Excretion mg./24h. urine	Calcium. Gross Retent. (mg./kg./ 24h.)	Phosphorus. Intake (mg./kg. 24h.)	Phosphorus. Excretion mg./24h. faeces	Phosphorus. Excretion mg./24h. urine	Phosphorus. Gross Retent. (mg./kg./ 24h.)
(1) Miyan	46	8m.	155.9	1275	2392	81	10.7	358.7	69.2	1.5	15.3	321	148.6	5.1
(2) Pangu	42	12m.	160.2	716	3864	53.1	11.7	168.9	59.9	5.8	16.7	193.6	299	4.9
(3) Lut	37.5	8m.	160.5	1515	2925	42.3	11.6	455.8	63.2	—2.2	17.6	418	309	—1.6
(4) Saka	43.4	±24m.	147	1536	3607	28.6	10.7	378.8	172.8	—4.4	15.4	332.5	408	—1.5
(5) Neng	46.1	12 m.	144.5	481	2986	69.3	9.8	136.5	172.8	2.7	14.2	169.6	273.5	5
Mean	43		153.6	1104 or 25.6 mg./kg /24h.	3155 or 73 mg./kg /24h.	54.8	10.9	299.7 or 6.9 mg./kg /24h.	107.5 or 2.5 mg./kg /74h.	+0.6	15.8	286.9	287	+2.4

The urinary nitrogen is low: 73 mg./kg./24 h. This is approximately one-quarter of the urinary nitrogen of normal Caucasians. One of our group (HOLEMANS, 1957) found a total urinary nitrogen value averaging 82 mg./kg./24 h. for 22 adult Basuku. This poor urinary nitrogen output is an index of the lack of protein in the diet and of a slight nitrogen retention. Faecal nitrogen is also low, 25 mg./kg./24 hours, representing half of the average value found in malnutrition and kwashiorkor, that is 51 mg./kg./24 hours, where 169 mg./kg./24 hours were ingested.

One may deduce that the intestinal absorption was 83 per cent., which is superior to the above cited experiment where 68 per cent. was observed. But, if one considers that the faecal nitrogen, does not exceed the metabolic faecal nitrogen which is' ± 30 mg./kg./24 hours, according to MITCHELL (1954), BRULL (1943), and HOLEMANS, LAMBRECHTS and MARTIN (1955a), one may conclude that the ingested nitrogen must have been absorbed at 100 per cent.

(ii) *Calcium and phosphorus.* The Ca/P ratio is 0.68 in the diet. For calcium as well as phosphorus, the intakes are low, near to the minimum requirement, since the balance is only just positive (+ 0.6 mg.) for an intake of 10.9 mg./kg./24 hours of calcium and + 2.4 mg./kg./24 hours for 15.8 mg. P. From these results, one finds that the nursing mothers studied have a minimum requirement in the vicinity of 10 mg./kg./24 hours for calcium and 15/mg./kg./24 hours for phosphorus, if one does not take into consideration the losses in the mother's milk

This value of the maintenance requirement for calcium can be noted in Fig 1, which is based on data of Table II which represent intakes and retentions for the 5 women under consideration arranged in groups of periods of 3 days On the graph, the results of the partial calcium balances group themselves to show a zero retention, i e the minimum requirement between 8 and 12 mg /kg /24 hour

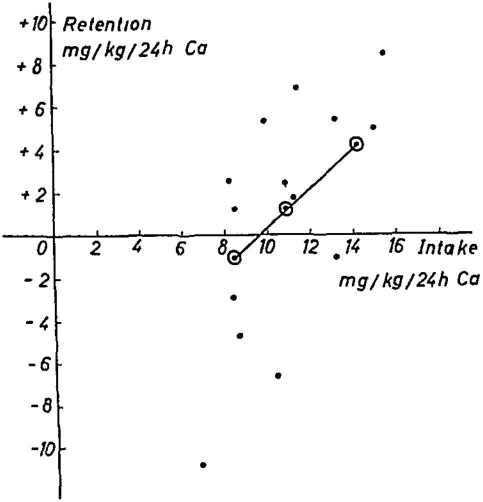

Fig 1 Comparison of calcium intake and retention (mg /kg /24 h)

● Individual figures taken from Table II

○—○ Mean values

(Losses in the breast milk are not considered)

Table II Calcium and phosphorus balances (mg /kg /24h) for three day periods for five nursing mothers (Loss in breast milk not considered)

Case	No periods	Calcium		Phosphorus	
		Intake	Retention	Intake	Retention
Miy	1	13 2	5 1	18 6	7 8
	2	10 9	2 4	15 1	7
	3	8 25	— 3	12 2	0 43
Pangu	1	15 4	8 3	22 3	7 1
	2	11 1	6 9	15 8	5 2
	3	8 2	2 4	12	2 6
Lut	1	15	4 9	21 6	3 2
	2	13	—1 3	18 4	0 3
	3	6 7	—11 1	12 7	—8 5
Saka	1	—	—	19 2	1 9
	2	10 5	—6 8	14 4	—3 2
	3	8 5	—4 9	12 7	—3 3
Nen	1	11 2	1 8	16 9	4 8
	2	9 9	5 1	14	8 1
	3	8 3	1 3	11 7	2 1

In other experiments (LAMBRECHTS, HOLEMANS and ROTS, 1956 ; HOLEMANS, LAMBRECHTS and MARTIN, 1956b), we have established the minimum values for Ca and P near to 14 mg. and 20 mg./kg./24 hours respectively for older children ; and at 20 mg. and 30 mg./kg./24 hours for malnutrition and kwashiorkor. The urinary secretion of calcium is normal at 2.5 mg./kg./24 hour.

In non-rachitic whites, P is eliminated especially by the kidney giving a $\frac{\text{Faecal P}}{\text{Urinary P}}$ ratio of between 0.5 to 1. The subjects of our experiments showed a ratio of $\frac{286.9}{287} = 1$, which is normal. In an earlier study of individuals with kwashiorkor, we have reported a ratio which is clearly abnormal (HOLEMANS and LAMBRECHTS, 1955b).

DISCUSSION

(a) *Losses due to lactation.* For technical and psychological reasons, we did not directly measure the milk secretion of the women studied. To appreciate the losses due to lactation, we used the average values established in a previous study of Basuku women in the same region with identical living conditions and diet (HOLEMANS, LAMBRECHTS and MARTIN, 1954a). We were able to establish that mothers nursing babies from 6 months onwards gave only 293 to 323 ml. of milk per 24 hours, or an average of 305 ml. The composition of the milk was protein 1.1 g. per cent., calcium 30 mg. per cent. and phosphorus 18 mg. per cent. Based on these values, we may estimate that 3.35 g. of protein, or 12.5 mg./kg./24 hours were lost by the mothers' milk each day, together with 2 mg. Ca/kg./24 hours and 1.2 mg. P/kg./24 hours. These losses have a negative influence on the balances cited above, and must be deducted from the gross retention to give an idea of the net nitrogen, phosphorus and calcium economy of these lactating African women.

(b) *Nitrogen.* Our subjects have a definite positive nitrogen balance : 153.6 mg. — (73 mg. + 25.6 mg. + 12.5 mg.) = 42.1 mg./kg./24 hours, the lactation being taken into onsideration. The true retention thus represents 27 per cent. of the intake. The positive [illegible] in our subjects indicates that most likely there existed a slight protein deficiency [illegible] usual diet containing approximately 25 g. of proteins per day or 93 mg. N/ [illegible]urs. HUNSCHER et al (1935) have described a notable protein retention from [illegible] week of lactation in a white·woman receiving more than 100 g. of protein per

[illegible]ation of the small amount of milk produced by Kwango women is [illegible]urprising, as it has often been said, without mathematical proof, however, [illegible] mother is a good wet-nurse quantitatively. However, if their diet and [illegible] phosphorus and calcium intakes are considered, it us unlikely that figures in the first 3 months and 300 ml. afterwards are notably inferior to reality. [illegible]liar with the fact that 2 g. of nitrogen are needed each day in the food for the [illegible] of 1 g. of N in the milk. To produce 4.4 g. of protein per day or 16 mg. N/kg./ [illegible]s, the body must take up 32 mg./kg./24 hours, from the 93 mg./kg./24 hours of dietary N that is included in the indigenous daily food and, this total amount is equal or inferior to the minimum requirement. It has also been shown that the milk secretion is influenced by the quantity of dietary N (HOLEMANS, LAMBRECHTS and MARTIN, 1956a). At any rate, it must be emphasized that the greater intake of N passing for a short period from 95 mg. to 153 mg./kg./24 hours has no influence on the secretion of breast milk, since the volume will only increase after a prolonged higher protein diet as we have noted during a campaign of protein supplementation Thus, this relatively poor secretion of milk could well be a defense mechanism against excessive and prolonged losses of N, Ca, P in mothers whose diet is poor in these elements

It is interesting to remark that the faecal nitrogen corresponds to the metabolic faecal nitrogen, which signifies that all the ingested nitrogen has been absorbed, giving 100 per cent intestinal utilization This efficiency is practically never found This might well be due to " adaption " to a low nitrogen diet in the same way as the body's reaction to a low calcium intake In any event, our results do not permit us to conclude that it is an inherent characteristic of the nursing African mother

(c) *Calcium and phosphorus* If we admit that the relatively small volume of milk produced by these nursing women corresponds to a loss of 2 mg Ca and 1 2 mg P/kg / 24 hour, the net balance for Ca becomes — 1 4 mg /kg /24 hour and for P, + 1 2 mg / kg /24 hour for the whole group studied Individually, 2 out of 5 mothers on the same average diet present a negative gross balance for Ca and P In these two cases, the calcium loss is largely faecal 9 and 12 mg /kg /24 hour against 3 to 7 mg /kg 23 hour noted in those with a positive calcium balance It is evident that these two women have a net balance, which is much more negative than the three others The negativity or the positivity of the balance bears no relation to the age of the child being nursed, that is the period of lactation

The minimum Ca requirement for the nursing African mother can thus be established, on the average, at 10 mg + 2 mg = 12 mg /kg /24 hour The Ca^{45} results in the same women correspond to this, being 10 mg approximately Details will be published elsewhere

Considering our findings, we can say that on a customary diet, one woman only out of five, has a positive net balance for Ca, the others being negative or just in equilibrium For P, the situation is a bit more favourable, the gross minimum requirement being near to 15 mg /kg /24 hour, and about 16 2 mg /kg /24 hour, when the loss by the milk is included The net balance is positive in three out of five cases

If our results could be extrapolated to the entire female population, we could state that *80 per cent of the lactating women of the territory (on the usual indigenous diet)* are in negative calcium balance or at risk of being so Their average intake of calcium does not exceed the minimal need, and, therefore, they are on the borderlines of demineralization The prolonged nursing period under these dietary conditions certainly constitutes a burden for African women It is quite probable, however, that in fact the situation is not so dramatic as it may seem We believe that the danger of demineralization is greatly lessened by the addition to the diet, of such fairly rich sources of calcium as green leafy vegetables (*Lambrechts, Holemans and Rots, 1956*) *In India*, Rau and Murty (1942) and Jengar and Rau (1952) have also both called attention to the green leafy vegetables as possible sources of calcium

The results of our experiments are similar to those obtained by Liu et al (1937) on Chinese women absorbing 200 to 400 mg of calcium per day

CONCLUSIONS

With the native diet enriched in N to 153 mg /kg /24 hour, the five nursing women studied by us for ten days all had a positive nitrogen balance with net retention This retention is no doubt the sign of a previous diet poorer in N than that of the experiment. In the same manner, the urinary nitrogen excretion was low — one fourth of the value of normal Caucasians. The faecal nitrogen indicates an excellent digestion and absorption.

The calcium balance is negative or just positive, while the phosphorus balance is somewhat more favourable, however. There can be no question that phosphorus-calcium metabolism at the limit of " non-equilibrium " constitutes a danger to these African women who prolong nursing 2 to 3 years, if the diet contains only the minimum requirement of N, Ca and P. According to our experiments, this minimum is situated below 150 mg./kg./24 hour for N ($\pm$ 100 mg.), and near to 12 mg./kg./24 hour. for Ca and 15 mg./kg./24 hour for P. These values can only be attained by the variety of foods that accompany the basic dish of cassava paste, that is with dried fish, green vegetables, caterpillars, fruits, and a variety of obscure snacks.

From the point of view of nitrogen and calcium-phosphorus metabolism and their minimal requirements, the nursing woman does not differ greatly from the average adult of the region. In the actual conditions of diet and lactation, it is quite probable that the mineral equilibrium is in fact achieved.

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IXth International Congress of Paediatrics

The IXth International Congress of Paediatrics is taking place from July 19-25, 1959 under the patronage of Her Majesty The Queen.

The Scientific Program is designed to follow the chronology of childhood, starting with the cell and progressing through to adolescence, each subject being developed through initial Plenary Sessions leading to Panel and Round Tabel discussions. Scientific Exhibits, of which an extraordinary number have already been submitted, will be selected to complement the scientific sessions. The Congress Committee is sparing no effort to make the Scientific Program an outstanding educational achievement. Participants in the Program will be those who have proven themselves to be outstanding workers in each field, and will be drawn from all corners of the globe. Friday afternoon (July 24) is being reserved for three addresses of particular significance.

Postgraduate students, introduced by their Department Heads, are welcome to attend the Congress at the reduced registration fee of $20.00 (the deadline for which is April 30, 1959).

A social and recreational program has been planned for wives of delegates as well as older children. The younger ones will have their own program of games and events, under the watchful eyes of qualified supervisors.

All registration should be in by January 31, 1959. If you wish further information do not hesitate to get in touch with the Secretary General, P.O. Box 215 Westmount, Montreal 6, Canada.

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EDITORIAL

ACCIDENTS IN THE TROPICAL ENVIRONMENT

In the temperate zone, accidents occupy a very prominent place among causes of death in early childhood. By contrast, little appears to be known about the situation in the tropics, and, although it is certain that the complex of diseases due to malnutrition, infection and parasitic infestation will head the list, nevertheless the problem of accidents in tropical children certainly warrants more attention than has been given it previously.

The actual pattern of accidents occurring in a tropical environment will, of course, vary both from place to place, and with the level of urbanisation, mechanisation and sophistication. If the latter have developed to a considerable degree, then traffic accidents, electrocutions and poisoning with more elaborate household drugs, such as aspirin and antimalarials, will tend to be on the increase.

In the rural areas where the majority of tropical children live, the pattern will be quite different, although, as anywhere, it will again be the highly mobile pre-school child, exploring the new world around him with all his senses and with poorly developed depth-vision, who will be most liable to come to grief. Traumatic episodes,including fractures from falling from trees, scalds and burns from the kitchen, and drowning from falling into the village pond or river, will be of importance ; while, in addition, certain special hazards may be present, such as the pit latrine into which the child can tumble, or the cracked, crumbling, mud walls of houses into which children may put their hands and be bitten by snakes or stung by scorpions.

While in both the town and country, kerosene, swallowed from a bottle kept as lamp fuel, will usually head the list, and lye, sometimes used in making local soap, of second importance, in the rural village poisons of vegetable origin, in the form of the berries and fruits of nearby bushes and trees, will figure prominently. Important, amongst those commonly reported (or indentified) are vegetable poisons containing various atropine alkaloids, such as the fruits of the datura lily, and the various Physic nuts (species of *Jatropha*). In addition, there may be particular localised plants with poisonous properties, such as the immature ackee (*Blighia sapida*) of Jamaica with its toxic hypoglycins. Some households may contain rather unusual poisons, sometimes required for a particular craft or trade. Thus, in parts of India, kite-makers keep finely powdered glass, which exactly resembles sugar, to apply with glue to kite strings and this can be ingested accidentally by small children.

It would be of interest to know if, in fact, any details are available concerning the prevalence of accidents among tropical children and the types of most importance. However, as it is certain that present data is extremely sparse, it would be very useful to try to collect data on both the accident situations to be found in town and village, and also the types of accident, including posioning, that do, in fact, actually occur, and the social pathology responsible. Lastly, it is surely time that guided by this type of information consideration be given to accident prevention in teaching in health centres, especially in relation to such common occurrences as burns and scalds.

THE BONE MARROW PICTURE OF TYPHOID FEVER IN CHILDHOOD

by

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The blood picture in typhoid fever has been known for a long time, and the most important changes are, according to the literature (BRADFORD, 1956, ABT, 1956 ; EMDIN, 1955 ; WINTROBE, 1956), leucopenia with disappearance of the eosinophilic cells and a relative increase of mononuclears. It seems that leucocytosis precedes the granulocytopenia in the first week of the disease, while the latter appears during the migration of the bacilli in the bloodstream (DIETRICH, 1937). Decrease of the haemoglobin content of the blood and the number of red cells are regularly observed (EMDIN, 1955; KUGELMASS, 1941). According to ABT and ABT (1956), the average loss of haemoglobin was 20 per cent and of erythrocytes one million in typhoid fever in children. Decrease of the blood platelets was observed by many authors (KUGELMASS 1951 ; EMDIN, 1955), especially in the febrile stages. The reticulo-endothelial system is affected too. ROWLAND and JAFFE (1956) noted proliferation of reticulo-endothelial cells and formation of miliary granulomas ; while CUSTER (1949) gave an excellent description of hyperplasia of the reticulo-endothelial system in typhoid fever. The bone marrow picture described by many authors can be summarized as follows : the marrow is rich in cells, while eosinophilic cells are always present, despite aneosinophilia in the blood (FLEISCHHACKER, 1950). *In the beginning of the disease, a metamyelocytic marrow, afterwards becoming myelocytic,* and seldom a myeloblastic marrow, can be observed (BARTA, 1933). Further, a shift to the left (HENNING, 1935), and according to REVOL (1938), a granulocytic reaction with a few myeloblasts can be seen. In a study of the bone marrow in 53 cases of typhoid fever, STORTI and FILIPPI (1937) found the following : (a) an increase of white elements and decrease of the nucleated red cells ; (b) slight decrease of the mature granulocytes and increase of the young elements ; (c) normal or subnormal number of eosinophils in the bone marrow, despite a decreased number of eosinophilic cells in the blood ; (d) a diminished number of mitotic figures.

Plasmocellular reaction does not seem to be very significant (FLEISCHHACKER, 1950), although CUSTER (1949) saw many foci of necrosis in bone marrow slides.

The pathogenesis of the changes in the blood picture in typhoid fever is by no means very clear. Some authors suggested a toxic destruction of leucocytes in the circulating blood as a cause of the leucopenia (GALLAGHER, 1933) ; others (HEILMEYER and BEGEMANN, 1951) suggested a connection with the relative bradycardia, which might slow down the release of the granulocytes into the blood. Up to the present, there is no solution as to why aneosinophilia exists despite the great number of eosinophils in the bone marrow.

According to KUGELMASS (1941), many factors could be responsible for the anaemia in typhoid fever : loss of appetite with diminished food intake, decreased absorption of erythropoietic nutrients, impaired utilization of haematinic substances, inhibition of bone marrow production or destruction of the circulating red blood cells.

The pathogenesis of the thrombocytopenia is still obscure. It is possible, but rather difficult to prove, that the spleen can be held responsible for the blood changes (splenic haematopenia).

Decrease of both granulocytes and blood platelets, as with decrease of red blood cells, can be the consequence of falling off in numbers of the young cells in the bone marrow (aplastic anaemia), lack of maturating factors in the bone marrow (deficiency), and increased destruction of the circulating cells in the blood (haemolysis, phagocytosis, a shortened life span of the cells), and in the case of red blood cells, by acute or chronic blood loss.

It is our experience that typhoid fever in children in Indonesia reveals the same blood changes described in the literature : anaemia, granulocytopenia, aneosinophilia and sometimes thrombocytopenia.

The purpose of this study was to attempt to discover if there is some correlation between the blood and bone marrow pictures in typhoid fever. In another paper the influence of chloramphenicol in the bone marrow will be discussed.

Materials and Methods

This material consisted of fifty patients, all children between two and twelve years of age, who were admitted in the Pediatric Clinic of the University of Indonesia in Djakarta. Twenty-six were girls and twenty-four boys. All these children suffered from typhoid fever, the diagnosis of which was made by the clinical picture, positive culture of *Salmonella typhi* in the blood, stool or urine and/or positive agglutination test against " O " and " H " antigens. Blood examinations were done on admission and at regular weekly intervals. Bone marrow punctures were done in the first weeks of hospitalization after the diagnosis was made, but before any antibiotic treatment (chloramphenicol) was given. Methods of blood and bone marrow examinations are given elsewhere (Kho Lien-Keng, 1957).

Results

These children were brought to the hospital with fever of at least one weeks duration at home and sometimes more. Apathy, hypotension, hypotonia and a coated tongue were common findings. The typical rash was never seen. Complications, such as diarrhoea with dehydration and toxicosis, were sometimes observed. Haemorrhages from the intestines occured very infrequently. Chloramphenicol was given to the serious cases or those with high fever, with delirium and cerebral manifestations. The mortality was very low, less than 2 per cent. Leucocytosis in the early stages or in cases with complications or secondary infections (pneumonia, otitis media, enteral infections), leucopenia and aneosinophilia were common findings in the febrile stage. Leucopenia of less than 6,000 per c.mm. was seen in 24 children, and a leucocyte count between 6,000 and 15,000 in most of the remaining cases, while in a few children a leucocytosis of slightly higher than 15,000 was present.

In 32 cases, no eosinophils were found in the differential count of the blood. Thirteen had an eosinophilia of 1-4 per cent while, in 5 children, the number of the eosinophils was between 5 and 8 per cent.

Anaemia with a haemoglobin content of the blood of 10 gm per. cent or less was almost always present on admission or during the stay in the hospital. Grave anaemias with haemoglobin less than 5 gm. per cent were sometimes observed. Moderate thrombocytopenia (20,000-100,000) was found in about one-fourth of the cases examined. Haemorrhagic diathesis (petechiae) occurred in one case. All these blood changes became normal after improvement of the disease.

The bone marrow findings of these fifty Indonesian children suffering from typhoid fever can be summarized as follows

(1) The concentration of cells and fat tissue could in most instances not be distinguished from a normal bone marrow smear

(2) The granulopoietic system seemed more active than normal (59 1 per cent in comparison to 52 2 per cent granulocytes in the normal) There was a shift to the left

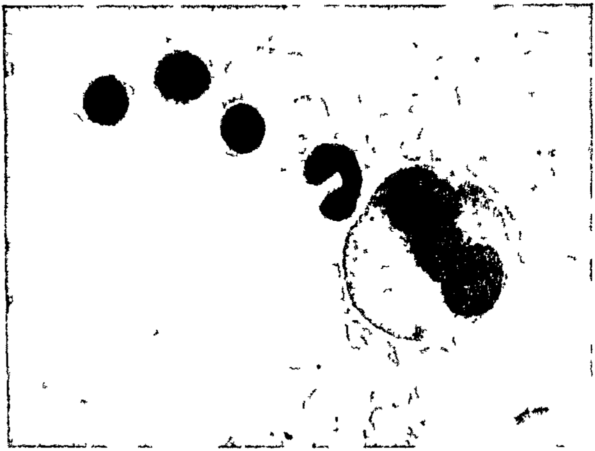

FIG 1 A giant eosinophilic stab cell in the bone marrow of a child with typhoid fever and aneosinophilia The diameter of this cell is 30 micron

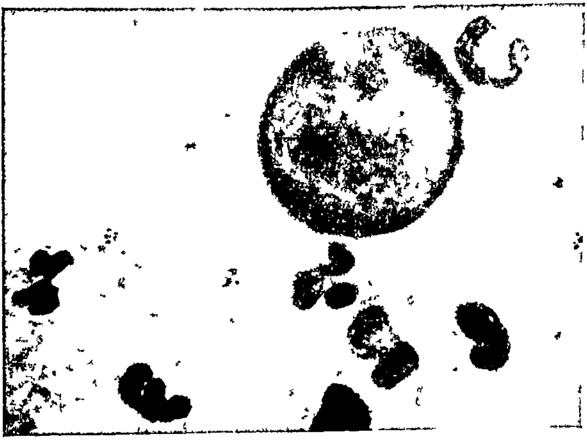

FIG 2 A giant pro-erythroblast in the bone marrow of a child with typhoid fever and an erythroblastic crisis The diameter of this cell is 50 micron Erythroblasts of normal size are absent

The number of eosinophilic cells in the bone marrow was decreased in comparison to normal (3.48 to 4.87 per cent), but many eosinophilic cells found in typhoid fever were young, most of them myelocytes, sometimes promyelocytes. Giant eosinophilic cells were frequently seen (22 cases), the diameter being four times that of the erythrocytes or more (Fig. 1). In a few instances, giant neutrophilic metamyelocytes or stab cells and vacuolization of granulocytes could be observed. It was our experience that the smaller the number of eosinophilic cells in the peripheral blood, the more giant eosinophilic cells could be found in the bone marrow.

(3) The erythropoietic system was characterized by a diminished number of erythroblasts in the bone marrow compared to normal (15.6 to 19.0 per cent). The mean myeloid/erythroid ratio in typhoid fever was significantly increased (10.5 compared to 3.2 in normal). In five instances (Cases 1, 5, 9, 25, 42 and 44), the bone marrow was aplastic. In some of these instances, giant pro-erythroblasts appeared in the bone marrow during the aplastic stage. Improvement of the bone marrow with a reticulocyte crisis in the blood, soon followed (Case 42), (Fig. 2).

(4) The thrombopoietic system was active in most cases. Total loss of megakaryocytes from the bone marrow was never encountered. In our material, there was only one case of typhoid fever with generalized haemorrhagic diathesis due to severe thrombocytopenia. The number of megakaryocytes in our cases was established by examination of the bone marrow slide with a low power A large number of megakaryocytes (more than 50 in one bone marrow smear) was encountered in 15 cases, a moderate number (10—50 megakaryocytes) in 26 cases, and a small number (1—9 megakaryocytes) in 9 cases.

All forms of megakaryocytes were present, from megakaryoblasts, pro-megakaryocytes, megakaryocytes to metamegakaryocytes (with platelet building). We had the impression there were more pathological forms as hypersegmentation and vacuolization, and less platelet-building megakaryocytes than normal in many instances.

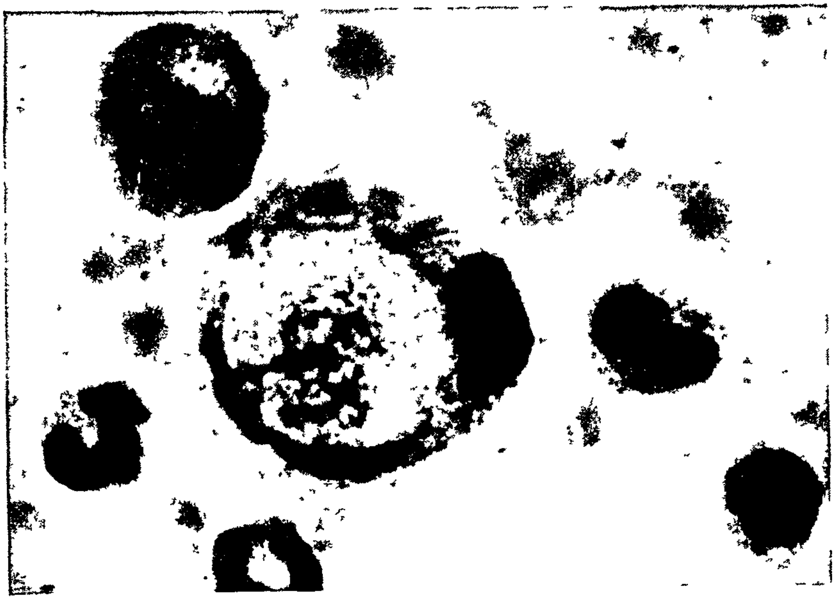

FIG. 3. A macrophage with a phagocytized granulocyte in the cytoplasm. The nucleus of the macrophage is pushed to the right side (case 43).

(5) The reticulo endothelial system activity in typhoid fever was evident from the increased number of reticular cells, plasmocytes, histiocytes, macrophages and unidentified cells in comparison with normal bone marrow smears Distinct hyperactivity of macrophages with phagocytosis of red blood cells, granulocytes or platelets in the cytoplasm were encountered in 10 cases (Figs, 3, 4, 5 and 6) These cells were larger, with a diameter of about 20 to 50 microns, and round with distinct cell contours The cytoplasm was light blue in colour, with red granules, cells or cell debris The nucleus was pushed to

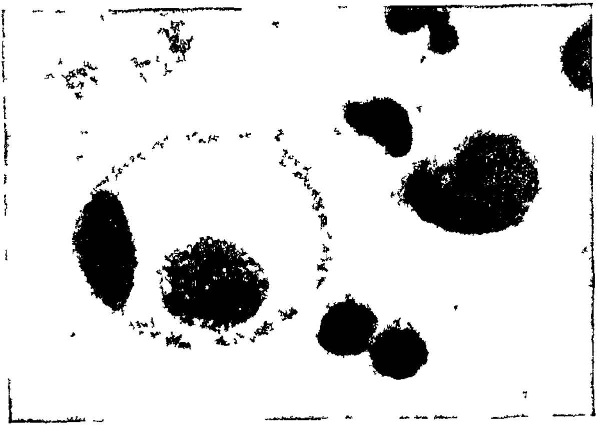

FIG 4 Phagocytosis of a myelocyte by a macrophage in typhoid fever with granulocytopenia (case 43)

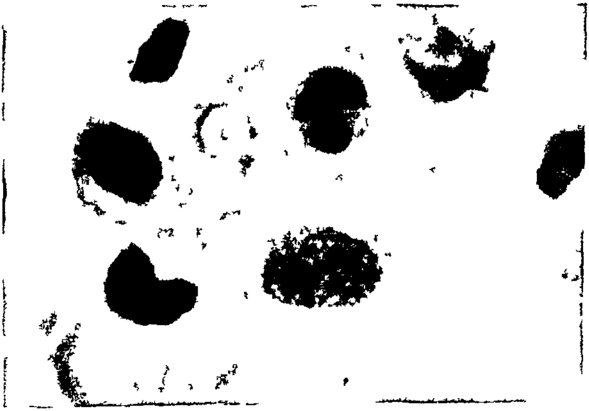

FIG 5 Phagocytosis of a polynuclear cell red blood cells and platelets by a macrophage or histiocyte in typhoid fever with pancytopenia (case 43)

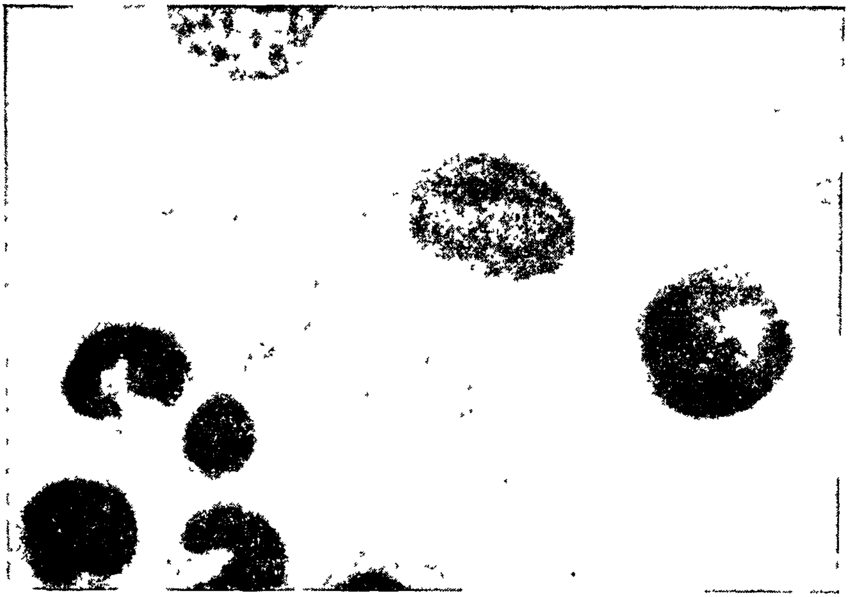

FIG. 6. Phagocytosis of many platelets and some erythrocytes by a macrophage in typhoid fever with thrombocytopenia and anemia (case 47).

the side. Mostly the colour of the cytoplasm was light in the centre. Phagocytic hyperactivity was seen in 10 of the cases.

CASE REPORTS

A detailed description of three cases of typhoid fever with changes of the bone marrow, follows :—

Case 42. A girl, two years of age, was admitted in the hospital with fever of two weeks duration. Sulphadiazine, penicillin-streptomycin and aureomycin had been given by the doctor without result. She was apathetic, languid, and looked rather ill. Temperature 39.5°C., bodyweight 8.4 kg., pulse rather weak, rapid and regular. Heart and lungs showed no particular change. The spleen was palpable two fingers below the costal arch and the liver one finger.

The stool contained mucus and scanty leucocytes ; *Salmonella typhi* were identified. The urine showed no abnormality. The blood revealed a positive agglutination test for typhoid "O" at a dilution of 1:800. Culture of the blood was negative. A blood count showed: haemoblogin 3.06 million, platelets sufficient, leucocytes 6,400 (eos. 0, stab. 1, poly. 60, lymph. 36, monos. 3). The Mantoux reaction was negative. Chloramphenicol treatment (4 x 250 mg.) was initiated on the fifth day and continued for six days. The fever disappeared after four days of therapy. Bone marrow biopsy was done on the twelfth day because the haemoglobin had dropped to 8 7 gm. per cent. and the leucocytes to 3,700 (eos. 0, stab. 2, poly. 4, lymphs. 93, monos. 1). The number of platelets was 298,000, reticulocytes 0 per cent. The bone marrow was rather rich in cells with scanty tissue ; the granulopoietic system was active with many young cells and vacuolization of the cytoplasm ; the erythropietic system was total aplastic. Giant pro-erythroblasts (Fig. 2) and a few giant eosinophilic cells were seen. Tissue mast cells and many histiocytes were present. There were many megakaryocytes. Differentiation of the bone marrow cells : myeloblasts 2 0, promyelocytes 5.2, myelocytes 23.8, meta 23.0, stab cells 14.2, polyn 7.4, eos. cells 1.8, basoph cells 0.2, giant pro-erythroblasts 0.4, basoph erythroblasts 0.2, polch. erythrobl. 0 8, plasmocytes 0 6, retic cells 0.4, histiocytes 0.2. Treatment consisted of blood transfusions on two consecutive days. The blood picture improved. The reticulocytes and the number of leucocytes increased gradually. The blood and bone marrow picture became normal two weeks afterwards, and the patient could be discharged in a good condition after five weeks of hospitalization.

Comment. This is a case of typhoid fever in a girl, in which an aplastic crisis had taken place. (This phenomenon occurs quite often in grave infectious diseases, such as meningitis, tuberculosis, kwashiorkor with secondary infections). Giant reticulohistiocytic cells and giant pro-erythroblasts appeared for a short time during the aplastic crisis (Fig. 7). This crisis lasted for two weeks and was followed by a reticulocytic crisis and erythroblastic activity of the bone marrow. This case showed a typical granulocytopenia and an eosinophilia with a relative lymphocytosis. Eosinophilic cells were scanty in the bone marrow. Giant eosinophilic cells were present.

Case 43 A boy of five years of age, was admitted in the Pediatric Clinic because of fever of one weeks duration He looked rather ill on admission, but was in good physical condition, and mentally normal, although weak The temperature was increased, the pulse regular and rather weak The tongue was coated There was no anaemia, dyspnoea or cyanosis Lungs and heart did not reveal any abnormality Liver, spleen and lymph glands were not enlarged The stools and urine were normal Blood examination Hb 9 4 gm per cent, Rbc 3 1 million, Wbc 4,600 (eos 3 per cent, poly 43 per cent, lymph 54 per cent) Platelets 21,000, reticulocytes 10 per cent Blood culture positive for *Salmonella typhi* 0 agglutinins for *S typhi* were positive in high dilution (1 400) The blood slide was negative for malaria Bone marrow biopsy revealed a picture which was rather rich in cells, with a hyperplasia of reticulo-endothelial elements, with many reticular cells, plasmocytes and macrophages These last cells were large, round with central nuclei The cytoplasm was light basophilic, with many phagocytized cells, such as erythrocytes, platelets, granulocytes and sometimes erythroblasts (Figs 3, 4 and 5) Megakaryocytes were found in sufficient quantities The differential count showed myelobl 0 4, pro myelocytes 4 4, myelocytes 12 2, metamyelocytes 14 0, stab cells 8 6, polyn cells 6 6, eosinophilic cells 0 2, pro erythrobl 0 8, macro normobl 1 4, basoph erythrobl 1 8, polychr erythrobl 2 2, acido ph erythrobl 1 6, lymphocytes 22 6, mono 3 2, plasmocytes 3 4, reticular cells 5 0 macrophages 1 4, fibrocytes 0 8, other cells 0 6

The bone marrow was poor in eosinophilic cells The eosinophilic cells found were large, with a diameter of about 30 microns, with often indented nuclei (giant eosinophilic stab cells or metamyelocytes or myelocytes)

Course of the disease The patient was not treated with chloramphenicol because of the condition of the bone marrow and the blood picture The fever lasted about 2 weeks, the eosinophilic cells appeared after 5 days of hospitalization (33 cells/cu mm) The bone marrow picture after 12 days disclosed only a few macrophages but still many plasmocytes The eosinophilic cells increased up to 1 2 per cent After one month, the bone marrow was normal with many eosinophilic cells (5 6 per cent), and no macrophages any more The patient was discharged in a good condition after 1½ months

Comment This was a case of typhoid fever, with anaemia, leucopenia eosinophilia and thrombocytopenia, with increased pathological activity of the RES in the bone marrow The phagocytosis of the blood corpuscles by the macrophages was partly responsible for the pancytopenia in the blood

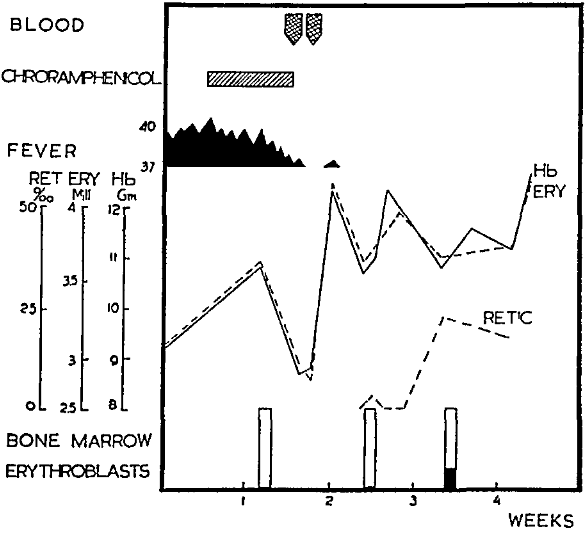

FIG 7 The course of the disease in typhoid fever with a erythroblastic crisis Note the absence of erythroblasts in the first bone marrow specimen and the good reaction to chloramphenicol and blood transfusions (case 42)

Case 47. A girl of six years of age, was admitted in the Pediatric Clinic, with fever of two weeks duration. The temperature was 39.5°C., the pulse rapid (144 per min.) but regular. She looked ill, stuporous, irritable and rather pale, and the tongue was heavily coated. There were rales in the lungs, while the heart was normal. The spleen and liver were palpable one fingers breadth beneath the costal arch. The stool contained ascaris and trishocephalus ova. The urine was within normal limits. Blood examination: Hb 8.3 gm per cent., Rbc 2.72 mil., Wbc 4,000 (eos. 0 per cent., stab cells 5 per cent., polyn. 54 per cent., lymph. 39 per cent., mono 2 per cent.), platelets 46,000, reticulocytes 3 per cent. The blood culture was negative. The agglutination reaction for *S. typhi* was positive at 1:100 (0). The blood slide was negative for malaria. The coagulation time was normal and the bleeding time prolonged (15 min.). The Rumpel Leede test was negative. The bone marrow was rather poor in cells, there was a hyperplasia of the RES with many reticular cells, plasmocytes and macrophages (Fig. 6). These macrophages were of the same type as in the former patient. Erythrocytes, platelets, granulocytes and erythroblasts were phagocytized. The number of eosinophilic cells was poor, there were many giant stab cells. Differential count (per cent.) ; myeloblasts 1.8, pro-myelocytes 0.2, myeolocytes 1.28, meta 4.8, stab cells 13.6, polyn. 6.0, eosinophilic cells 2.8, pro-erythroblasts 0.2, basoph. erythroblasts 0.4, polychr. erythroblasts 5.2, acidoph. erythroblasts 22.2, lympho 24.4, mono 0.2, plasmocytes 2.4, reticular cells 1.2, plasmocytes 2.4, reticular cells 1.2, other cells 0.8.

Course. Chloramphenicol was only given for 2 days because the number of leucocytes dropped to 3,800 per cu. mm. Blood was given twice—200 cc. on each occasion. Procaine penicillin was given for 8 days because otitis media had developed as a complicating factor. The temperature returned to normal after one week. Daily examination of the blood revealed a normal number of platelets after 12 days. Eosinophilic cells appeared after 8 days, and the reticulocytes increased gradually, although the leucocytes were still low after 2 weeks. The bone marrow biopsy became normal after 10 days.

Comment. This is a case of typhoid fever with pancytopenia and pathological hyperactivity of the reticulo-endothelial elements in the bone marrow.

DISCUSSION

Leucopenia in typhoid fever is caused by a diminished number of granulocytes in the blood. The mononuclear cells are relatively increased. It is a fact that in our cases leucopenia was found in about half of the cases during the febrile stage, the other half showing between 6,000 and 15,000 leucocytes, this being the normal values for children between 4 and 7 years according to GARREY and BRYAN (1935). A few were even higher. In our opinion, the relatively increased number of the leucocytes was due to the frequent secondary infections (pneumonia, respiratory tract, alimentary canal) encountered in our cases. According to ROHR (1949) granulocytopenia can have four different types of pathogenesis :—

(i) a hyper-acute form with the classical picture of Schultz's agranulocytosis, on an allergic basis and mostly caused by infections or toxic-allergic agents such as amidopyrin, barbiturates, salvarsan, sulphonamides, dinitrophenol etc. ;

(ii) a more chronic form, as in tuberculosis, malaria or some toxic medicaments such as arsenic, gold, salvarsan, sulphonamides, thiouracil, benzol, X-rays and radium.

(iii) granulocytopenia caused by hypersplenism.

(iv) secondary granulocytopenia caused by tumours, reticuloses, and leukaemias.

It seems that maturation arrest of the granulopoietic system is the most important feature in mild and moderate forms of granulocytopenia. In these instances, there is an increase of the myelo-promyelocytic, or the pro-myelocytic-myeloblastic forms, depending on the seriousness of the condition. In the most serious forms, all granulocytic cells disappear from the bone marrow. With regard to our material, we can conclude that in most cases the granulopoietic system was only slightly affected, as many cases had a maturation arrest in the metamyelo-myelocytic stage. Severe forms with a maturation arrest of the younger cells or disappearance of the granulocytes from the bone marrow were not encountered.

The eosinophilic cells, however, were very much affected. Not only was the number decreased in general, but in many instances we may speak of an eosinophilic crisis with total loss of eosinophils from the bone marrow. In these instances, giant eosinophilic cells (stab cells, metamyelocytes, myelocytes, pro-myelocytes) appeared in the bone marrow. Our observation of diminished eosinophilic cells (aplastic eosinopenia) in the bone marrow as a cause of the decrease of eosinophils in the blood in patients with typhoid fever is confirmed by experimental studies in rate by WALLON and BROWAEYS (1957). Injections of cortisone in massive dosage and injections of the rats with *Salmonella enteridis* Danis caused a distinct diminution of the eosinophilic cells from the bone marrow.

It is clear from our observation that typhoid fever in children can cause a decrease of the erythroblasts from the bone marrow. In some instances, an erythroblastic crisis occurred temporarily (Cases 1, 5, 9, 42 and 44). The bone marrow improved with improvement of the condition. This erythroblastic crisis is a phenomenon frequently observed in childhood in different infectious conditions (GASSER, 1952 ; KHO LIEN-LENG, 1957). In these conditions, we never fail to observe the temporary appearance of giant reticulo-histiocytic cells and giant pro-erythroblasts in the bone marrow. It is even our opinion that the findings of these cells is pathognomonic of an aplastic crisis. The pathogenesis is obscure. GASSER believes this due to allergy in a liable bone marrow, while KHO LIEN-KENG feels that insufficiency of the bone marrow is related to protein deficiency and imposed infections. Our material did not include cases of such severe malnutrition as kwashiorkor, but most of the children were dystrophic.

The number of megakaryocytes was slightly decreased in only nine cases, as judged by direct examination of the bone marrow smear. It is by no means certain if this is important in the pathogenesis of the decrease of the blood platelets. We did not make a differential count of the different form of megakaryocytes. According to DAMESHEK and MILLER (1946), *in idiopathic thrombocytopenic purpura, although the number of* the megakarycocytes is increased, the number of the platelet-forming megakaryocytes is diminished. It is our experience that in most cases the number of the platelet-forming megakaryocytes appeared to be present in sufficient numbers.

The reticulo-endothelial system (RES) was very active in our cases. This could be explained by the fact that the body was attempting to mobilize the defence mechanism by direct phatocytosis of the invading micro-organism and by the formation of antibodies by cells from the RES. According to FRAGAEUS (1948), the plasmocytes are especially responsible for this. The phagocytic activity of the macrophages were in our opinion pathological to the extent that " normal " granulocytes, erythrocytes and platelets were destroyed too. This excessive destruction of the blood cells by the RES, not only in the bone marrow but in other organs too, appeared to be an important role in the pathogenesis of the pancytopenia in typhoid fever.

It is a well-known fact that phagocytes, or macrophages, or mononuclear histiocytic cells with phagocytized blood cells are found in abundance in typhoid fever in the lymphoid tissue of the bowel, in the lymph nodes, spleen and bone marrow. (BOYD 1947, ANDERSON, 1948).

Although in most of our cases the spleen was not palable and only in a few instances was it slightly enlarged, we are of the opinion that in typhoid fever so-called " hypersplenism " plays an important part.

In our study we could not rule out the possiblity of an acquired immunohaemolytic anaemia, immuno-granulocytopenia or immuno-thrombocytopenia (MOESCHLIN, 1957) as a cause of the blood changes, in which auto-antibodies were produced as reaction to certain antigens.

The changes in the bone marrow during the febrile stage are the direct consequences of invasion of the bone marrow by the bacilli. STORTI and FILIPPI, (1937) found positive cultures of the bone marrow in 51 out of 53 cases.

We are of the opinion that the main blood changes in typhoid fever are the consequences of two important factors.:—

(i) decrease of the blood forming cells in the bone marrow as well as maturation arrest of the bone marrow cells ;

(ii) increase of the destruction of the blood cells in the RES by phagocytosis.

SUMMARY

This is a study of the bone marrow, obtained during the febrile stage, from fifty children with typhoid fever, admitted in the Pediatric Clinic in Djakarta. The blood picture of these children was characterized by leucopenia in half of the cases an eosinophilia in most cases, slight anaemia in most cases and moderate thrombocytopenia in one-fourth of the cases.

The bone marrow was characterized by an active granulopoietic system with a shift to the left and an eosinophilic hypoplasia or aplasia, an erythroblastopenia or acute erythroblastophithisis, and a sufficient number of megakaryocytes in most cases. The reticulo-endothelial system was hyperactive, with an increased number of plasmocytes, reticular cells, histocytes and macrophages. Giant pro-erythroblasts, giant eosinophilic cells and phagocytosis of granulocytes, erythrocytes and platelets by macrophages were frequently encountered.

The authors are of the opinion that the blood changes are caused by a decrease of the blood forming cells in the bone marrow and an increased destruction of the blood cells by the reticulo-endothelial system.

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THE STATE OF VITAMIN B_6 DEFICIENCY AS MEASURED BY URINARY XANTHURENIC ACID

by

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Vitamin B_6, or pyridoxin, was identified by Burch et al (1935) as the cause of a particular type of dermatitis in rats, which they called acrodynia In 1936, they discovered its chemical nature and called it vitamin B_6 (Burch and Gyorgy, 1936) The vitamin was isolated in 1938 by a number of workers and its structure was determined in the same year and found to be *2-methyl-3 hydroxy 4 5 dihydroxymethyl pyridine*

Snell et al (1942) discovered a form of synthetic pyridoxin which is more active than the vitamin
This was found to comprise two derivatives of pyridoxin an aldehyde
Harris et al (1944) determined their structure and
forms gave them properties other than those possessed
hown that members of the vitamin act as co decarboxy
lases Lichstein et al (1945) have shown that pyridoxal phosphate is a part of the transaminase system and of the tryptophane synthesising mechanism of neurospora

That trytophane, in the presence of B_6 can be converted into nicotinic acid, is a well established fact *The intermediate substance in nicotinic acid synthesis was found by* Bonner *(1948) and by* Mitchell and Nyce (1948) to be 3 hydroxy anthranilic acid Heilberger et al (1948) by feeding rats with isotopic tryptophane C^{14} in the b position, found that kynurenine excreted in urine contained C^{14} in the b position while kynurenic acid contained isotopic C^{14} in the b position of the pyridine ring The N methyl nicotinamide, on the other hand, contained no isotopic C^{14} They assumed that the pyridine ring of nicotinic acid is formed by oxidative rupturing of the benzene ring of hydroxyanthranilic acid, loss of a carbon atom and recondensation of the amino group to form the pyridine ring

Schweiger and Pearson (1947) found that, when tryptophane is fed to pyridoxin deficient rats, nicotinic acid synthesis is greatly reduced while xanthurenic excretion is greatly increased They also found that a high intake of tryptophane either as free amino acid or as casein causes B_6 deficiency Junquira and Scheigert *(1947) found that, besides* B_6 *thiamine and riboflavin are needed for the conversion* of tryptophane to nicotinic acid Portal et al (1947) found that riboflavin deficiency affects nicotinic acid synthesis while B_1 has little effect

The first convincing revelation of an essential dietary need for B_6 in infant nutrition under natural circumstances was made during modification of cow's milk to adjust its composition to be similar to that of human milk

Briggs and Cooper (1952) reported that groups of infants fed liquid S M A milk developed a syndrome of general irritability and easy startling, gastro intestinal excitability as indicated by colic, abdominal distention, vomiting and diarrhoea, punctuated by convulsive seizures at varying intervals The same observations were made by Molony and Armelle (1954) and Coursin (1954) Vilter (1955) noticed that chronically malnourished individuals manifest less insomnia and nervousness, and improve in strength whenever pyridoxin is administered The same author using the pyridoxin antagonist, 4 desoxy-pyridoxine, could elicit the following lesions seborrhoeic dermatitis, hyperpigmentation, glossitis, cheilosis, conjunctivitis, and sometimes peripheral neuritis Most of his cases showed anorexia, weight loss and convulsions when big doses of the antagonist were given In the same series, an increase in the urinary output of xanthurenic acid following a test dose of d-l-tryptophane was associated with B_6 deficiency This test was earlier devised by Chiancone (1952) who suggested the xanthurenic acid index as a test for B_6 deficiency. This procedure was used to assess the state of B_6 in pregnant women suffering from nausea and hypertension.

Verga (1951) described conditions of pyridoxin deficiency in a case of progressive muscular dystrophy and in an epileptic as judged by high levels of xanthurenic acid in the urine. The same test has been used by Adams (1954) to show the existence of B_6 deficiency in the infantile convulsive syndrome following the ingestion of the S.M.A. milk. Rabe and Bolonko (1956), using this test and the 4-pyridoxic acid excretion test, concluded that the first is the most sensitive of the three. The same authors demonstrated B_6 deficiency in the following clinical groups : (i) 4 children with hypochromic microcytic anaemia ; (ii) 4 children with convulsions (cause not mentioned) ; (iii) 9 children with miscellaneous acute infections.

The aim of the present study was to investigate the state of B_6 adequacy in infants under normal and abnormal conditions by estimating the urinary xanthurenic acid and using it as an index of B_6 deficiency. Such a deficiency may be of importance both for diagnosis and therapy.

Technique

The method used for the determination of xanthurenic acid is that of Rosen, Lowy and Sprince (1951) with some modifications. The urine collected, either a 24 hour specimen or a morning sample, was adjusted to pH8 by the addition of sodium hydroxide, and then filtered. Four ml. of the filtrate were pipetted into a clean, dry test-tube and 4 ml. of distilled water, 1.5 ml. of 5 per cent. $NaHCO_3$ solution and finally 0.5 ml. of 1.7 per cent. of $FeNH_4(SO_4)$ 2.12 H_2O solution were added. The tube was left for a minute, shaken gently and left for another minute. The cloudy solution was filtered and a greenish-yellow solution was finally obtained, which was matched against a control.

The control solution was made by taking the same amounts of urine filtrate, water and bicarbonate solution and the volume was completed to 10 ml. by the addition of distilled water. The matching of colours was undertaken with a " Unicum " electric spectrophotocolorimeter, with a filter at a wave length of 610 mu. The colorimeter was first adjusted by setting the galvanometer at 100 with control urine and the reading was again taken with urine treated with ferric ammonium sulphate. The amount of xanthurenic acid in urine was easily calculated by reference to a standard curve. This standard curve was made by using a very pure sample of xanthurenic acid, kindly supplied by Prof. Chiancone, dissolved in 5 per cent. $NaHCO_3$ solution and used as a stock solution. Various dilutions were made and in each tube 1.5 ml. of bicarbonate and 0.5 ml. of ferric ammonium sulphate solution were added and the volume was finally adjusted to 10 ml. by the addition of distilled water. The green colour obtained was matched against distilled water. The readings were plotted against concentrations which yielded a straight line.

Table I. Excretion of xanthurenic acid in normal children.

Age	Wt. (lbs.)	Sex	Gastric dist.		R.	XA y% urine
			V.	D.		
40 days	6	M	—	—	94	800
2 m.	5	F	—	—	100	0
3 m.	12	M	—	—	94	800
6 m.	7	M	—	—	94	800
6 m.	7	M	—	—	94	800
7 m.	6	F	—	—	96	500
8 m.	7.5	M	—	—	94	800
3 y.	15	M	—	—	96	500
3 y.	12	M	—	—	94	800
3.5 y.	12	F	—	—	94	800
3.5 y.	12	M	—	—	94	800
4 y.	6	M	—	—	100	0

CASES

The group of normal children were selected to fulfill the following conditions : (i) to conform to the normal average height and weight with a variation of ± 10 per cent. ; (ii) to be completely healthy, showing no obvious disease or nutritional deficiencies at the time of study and in the near past.

The group of abnormal children studied consisted of the following : (i) kidney diseases (acute nephritis and the nephrotic syndrome) ; (ii) liver diseases (infective hepatitis) ; (iii) nutritional diseases, including wasting, wasting with vitamin deficiencies, kwashiorkor and pellagra ; (iv) nervous diseases (mental retardation, cerebral palsy, tetany and recurrent convulsions) ; (v) gastrointestinal diseases (simple dyspepsia, dyspepsia with dehydration and intoxication) ; (vi) muscular dystrophy.

The results are seen in Tables I and II.

DISCUSSION

The normal children and infants (12 cases), who were subjected to the quantiative estimation of urinary xanthurenic acid, varied in age from 40 days up to 4 years. 9 were males and 3 females, 4 of them were under 6 months, 2 between 6—24 months and 6 between 2—4 years. 5 of those below 6 months were exclusively breast fed and one was on a mixed diet (breast and cow's milk). Those above 6 months were taking a suitably balanced diet.

The amount of urinary xanthurenic acid estimated in gammas % urine ranged from 0—800 y. with an average of about 600 y. The amount excreted was found to be independent of age, sex and the normal variations of weight. However, it seems that the diet has an effect as it was found that breast fed infants excreted less xanthurenic acid than those receiving a mixed feeding, i.e., breast and cow's milk ; or those on exclusively artificial formula. After weaning, the change of diet had no effect on xanthurenic acid (XA) excretion.

Out of the 58 abnormal children investigated, 12 were syndromes due to malnutrition, 8 males and 4 females. Their age varied from 5 months—6 years, 11 cases were below 3 years and one was over this age. The average XA excretion was high in all cases but was more pronounced in cases of kwashiorkor. The XA was found to range from 1,050—2,000 y. per cent. urine, with average of 1600. Age and sex had no effect on the amount excreted while the duration of the illness, as well as the severity of the case was found to affect its excretion. 7 of these cases were given 20 mg. of vitamin B_6 intramuscularly twice daily before the repetition of XA estimation. In most cases, this led to the return of XA to its normal level suggesting that the increased amount of XA excretion is due to deficiency of this vitamin.

There were five cases of pellagra, 2 males and 3 females, all of whom showed the full-blown picture with the characteristic dermatosis and gastro-intestinal upset, but no neurological manifestations. In this group, the urinary XA was within normal limits.

Tryptophane in a dose of 0.54 gm./kg. body weight was given to 2 cases but the excretion of XA was not influenced. These findings might suggest that pellagra is not related to B_6 deficiency.

TABLE II. Xanthurenic acid excretion in children with various diseases.

Age	Wt. (lbs.)	Sex	Xanthurenic acid (y% urine)
(I) *Nervous Diseases*			
(1) *Mental retardation*			
3 m.	12	F	0
2 m.	3.5	M	0
(2) *Cerebral palsy*			
2 m.	10	M	800
8 m.	5	M	500
(3) *Epilepsy*			
1.5	9	F	250
2	3.5	M	0
(4) *Recurrent Convulsions*			
10	26	F	0
2 m.	3.5	M	0
(II) *Kidney diseases*			
(1) *Acute Nephritis*			
4	14	M	1050
2	13	M	2500
1.5	9	F	1050
3	13.5	F	2000
4	15.5	M	1300
4	18	M	1300
4	19	M	1050
4	18	M	1050
(2) *Nephroses*			
4	17	M	0
7	25	M	0
3	17.5	M	500
3	14	M	1500
4.5	22	M	800
(III) *Liver diseases*			
Infective hepatitis			
3	13.5	F	2000
6	17	F	1050
6	17.5	M	1050
6	18.5	M	1500
3	15	F	1300
3	12	M	1050
(IV) *Nutritional diseases*			
(1) *Kwashiorkor*			
1	6	F	2000
3	8	M	2000
5	3.5	M	2000
5	3.5	M	0
3	10	F	800
3	10	F	250
(2) *Wasting*			
1	5.5	M	1050
10	5.5	F	1050
6	16	M	500
5	5	M	250
1	5	M	0
(3) *Pellagra.*			
6	14.8	F	250
8	24	F	250
4	14	F	0
5	16.5	M	250
10	31	M	250

Simple and "toxic" dyspepsia were also investigated for XA excretion. Four cases were suffering from simple dyspepsia, the duration varied from 1—3 days. All had diarrhoea and vomiting, but neither marked constitutional disturbances nor dehydration were present. This group showed an average excretion of XA which was within normal limits. The group of toxic dyspepsia cases, included 5 children varying between 2.5 months—12 months of age. They showed, besides diarrhoea and vomiting, signs of toxicity and dehydration. The degree of severity was almost equal in all cases and the duration of the disease was from 1—2 days. In this group of cases, the XA excretion varied from 1,050—1,375 y. per cent. urine with an average of 1,060. There was no relation between the increased excretion of XA and any particular sign or symptom. The level of XA was found to be influenced by giving parenteral vitamin B_6 during the course of the disease and it returned to normal after recovery.

The renal diseases investigated were acute nephritis and the nephrotic syndrome. Eight cases were suffering from acute nephritis and showed oedema, hypertension and abnormal urinary findings. None of the cases had heart failure or uremia. The XA in urine varied from 1,050—2,500 y. per cent. urine with an average of 1,300, showing a marked elevation over the normals. There was a consistant relation between the level of XA excreted and severity of the disease, i.e., cases with marked oedema and high blood pressure showed high values for XA and vice versa. Vitamin B_6 in the aforementioned doses was given to some cases, but the level of XA excreted was not greatly influenced. The relation between XA excretion and the progress of the disease will be the subject of a further study.

The five cases of the nephrotic syndrome showed marked and long-standing oedema, massive albuminaria, very low blood proteins and high cholesterol level. With the exception of one case (No. 33), which had an acute attack on top of the nephrosis, the XA excretion fell within the normal range irrespective of the severity or the duration of the disease. Case No. 33 showed elevated XA similar to the previous group of acute nephritis.

Six cases of infectious hepatitis were also examined and all showed a consistant rise of XA in urine. The level varied between 1,050—2,000 y. per cent. urine with an average of 1,300. On giving vitamin B_6 to 3 cases in the same dose mentioned, the XA level was not altered appreciably. This might be due to the fact that vitamin B_6 to be utilised must be phosphorylated in the liver, the function of which is impaired in these cases. There was a correlation between the severity of the case and the amount of XA excreted, that is the more severe the case, the greater was the excretion and vice versa.

A group of children with mental retardation, cerebral palsy, epilepsy and recurrent convulsions were examined for a relation between these diseases and the state of vitamin B_6 deficiency. Eight children varying in age from 2 months up to 2 years were examined. In this group of cases, the amount of XA excretion was within normal limits. The importance of this finding may be to separate the rare cases with nervous manifestations due to B_6 deficiency from others produced by organic diseases of the nervous system.

Pseudohypertrophic muscular dystrophy was studied as an example of muscle disease. In the 4 cases studied, excessive XA excretion was noticed, ranging between 1,050—2,500 y. per cent. urine with an average of 1,600. The more advanced the condition, the higher the XA level and vice versa. The amount of XA excretion was restored to normal levels after vitamin B_6 administration, especially to mild cases (such as No. 65), but was not appreciably altered in advanced cases.

SUMMARY

A modified method for the estimation of urinary xanthurenic acid (XA) was used as a test for estimating the state of vitamin B_6 nutrition in normal and abnormal infants and children. The normal infants and children selected (12 cases) were found to excrete an amount of XA ranging from 0-800 gamma per cent. urine. In cases with malnutrition, toxic dyspepsia, acute nephritis, infectious hepatitis and muscular dystrophy, there was an increased excretion of XA and the amount excreted was found to be dependent on the severity of the case. In all the cases mentioned, with the exception of acute nephritis and liver hepatitis, the amount of XA was restored to the normal levels after ingestion of vitamin B_6. In mental retardation, cerebral palsy, recurrent convulsions, nephrotic syndrome and pellagra, the amount of XA excreted was found to be within the normal range indicating that vitamin B_6 is probably not concerned in these cases.

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AN ACCOUNT OF SOME OF THE BELIEFS AND SUPERSTITIONS ABOUT PREGNANCY, PARTURITION AND INFANT HEALTH IN BURMA

by

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Some of the dangers of local customs relating to pregnancy and parturition have been described by ELLIS (1956), while the absolute necessity for the study of local cultural patterns (which may not all be bad) in order to become a practical pediatrician in the tropics has been very clearly shown by JELLIFFE (1956) WILLIAMS (1958) recently has underlined further the importance of investigating all social factors connected with nutritional diseases An Editorial in the *Journal of Tropical Pediatrics,* (1957) stressed the need for some instruction in elementary socio-anthropology for all engaged in pediatrics in the tropics and sub tropics This paper, is an attempt by an amateur at a socio-anthropological study of factors associated with pregnancy, parturition and infant life in Burma

Burma lies on the east side of the Bay of Bengal and countries having a common border from North to South are India, China, Indo China, Thailand and Malaya Her peoples are very mixed and include, besides Burmans, Karens, Chins, Kachins, Arakanese, Mons or Talaings, Kayahs, Shans, Lushais and Palaungs, in addition to Chinese and Indians who have settled in the country Special beliefs of the various hills peoples are outside the scope of this paper The predominant religion is Buddhism, but, as MAUNG MAUNG (1956) writes , " Buddhism stands detached from the earthly affairs of man In his marriage and family affairs, acquisition of property, contracts and business relations, Buddhism is uninterested "

There is no doubt but that many of the attitudes, superstitions and beliefs in the following pages are based on the Hindu influence which was particularly strong in all spheres of Burmese life, particularly law, up to the 18th century The only possible connection with marriage might be considered applicable to those who observe the 8 Buddhist precepts by which a man is expected to give up all worldly desires, including living with his wife

Before Buddhism was embraced, the Burmese religion was animism, and to day belief in spirits or *nats* is widespread and very marked HALL (1950) writes " The national religious festivals of to day were all originally animist " The water festival, *Thingyan,* celebrates the annual return of the King of the Spirit World, the *Thagya Min,* to the earth And the light festival, *Thadingyut,* commemorated the descent of *Gautama* from the spirit land where he had been lecturing on the law to his mother who was Queen of the *nats* Fireworks are set off to celebrate his return This festival ends the Buddhist equivalent of Lent in October, and as Hall writes " is a clear case of a Buddhist legend being grafted on to a pre-Buddhist practice "

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* I am deeply grateful to my colleagues and to my many Burmese friends, who have so patiently and willingly replied to my incessant questioning

DIET OF A PREGNANT WOMAN

There appear to be no food taboos in Burma of the sort described by TRANT (1954) in East African and probably few " cultural blocks " as described by JELLIFFE (1957) in Bengal. Burma is a rich country and, with the exception of Rangoon, malnutrition is relatively rare.

It is probable that fear of a difficult labour is the predominating thought that occupies a Burmese woman's mind during the course of her pregnancy and, for this reason, she tends to eat rather less than usual. How understandable this is may be realized from reading in the following pages the various methods of dealing with the common complications of pregnancy. Hence the main concern of antenatal diet is concentration on those foods which are believed will bring about a not-too-heavy baby with a small head.

Food is fundamentally divided into " hot " (*ah pu za*) ingredients and " cold or cool " (*ah aye za*) ingredients. There is, in Burma, a third group of foods, called *tet-za*. This includes Burmese mint, frogs, rats, deer and buffalo meat and is said to contain a special poison which may lead to pains in the head or arms. Hot food include chillies, peppers, honey and durian (this is a spiky fruit which has a strong smell and is occasionally eaten to give a large baby when a mother has had a succession of very small babies. It is also considered to be a mild aphrodisiac). Cold foods include melons, mangosteens, water, oranges, cucumbers and limes (such foods should never be taken by people suffering from coughs or colds since they tend to produce and increase phlegm. This belief also exists in Bengal as reported by JELLIFFE (1956) and in rural parts of South America (FOSTER, 1951).

JELLIFFE (1956) writes : " This system appears to stem ultimately from the humoral pathology of Hippocrates and Galen, which reached mediaeval Europe via the Arab World and was transmitted to Hispanic America by the Conquistadores. " The " Hippocratic " teaching treated the body as a mingling of the four elements, earth, air, fire and water (leading to four humors, blood, phlegm, black bile and yellow bile), and has been traced back to Empedocles (about 500 B.C.), but according to SINGER (1949) are probably much older. JELLIFFE (1956) puts forward the view that since this concept is a very ancient belief in India, dating back to early Sanskrit Ayurvedic literature, it is possible that it originated there and then afterwards spread to Greece. BARUA (1955) draws attention to the great antiquity of Indian medicine and notes that in the Ayurdeva, the 4th Veda (1500 B.C.) declares that *Brahma* is the source of all medical knowledge. It is also an ancient belief in Burma, and could date from about 500 A.D. when there was considerable Hindu expansion, and probably the first main Indian contact with Burma.

Normally, pregnant women do not drink milk *per se* because they " do not like the smell. " In fact, there is an old superstition, which claims that if a woman drinks milk during the antenatal period she will not have a normal lochia. The pregnant woman will however drink milk preparations such as " Horlicks, " " Ovaltine " and " Milo " etc. Little provision is made for them to have a special diet although in some places the eating of small fried birds (i.e., snipe and sparrows) is encouraged. Food cravings are satisfied by eating sour things. Diet is also governed by astrology — the woman's date of birth may govern whether she may or may not eat certain foods.

Fresh coconut milk may be given in the later stages, because this is considered to be one of the foods which lead to the easy expulsion of a baby with a small head. A further method of arranging this is to rub saffron into the pregnant abdomen, this acts against the poisons associated with pregnancy. It is said that if coconut milk is drunk from the seventh month onwards the baby will be born with no lanugo. In this context, it is interesting that TRANT (1954) reports that a pregnant East African girl may not drink milk for fear of spoiling her own milk or causing the child to be covered with a white coating (probably vernix caseosa), which might cause a more difficult labour. Bananas are not eaten since these lead to large babies. After a few months of pregnancy " hot, harsh or sour " foods should not be eaten because they may cause diarrhoea and thus lead to a precipitate premature delivery. At the same time, green vegetables must be avoided as they can cause stomach pains and indigestion. They may " give irritation " and harm the baby *in utero*. Orange juice which is universally used antenatally in the West has been tried in Burmese clinics, but the drinking of it is absolutely contrary to Burmese belief since it is considered to lead to a cough with phlegm.

Should a woman give birth to a deformed child, it is taken to mean that she has committed some sin in the past, and is a grave reflection both on her and on her family. For this reason, certain foods are avoided. For example, a pregnant woman will never eat two bananas (or other fruit) which are joined together since this may result in twins or a deformity (i.e., Siamese twins).

MODE OF LIFE OF A PREGNANT WOMAN

Pregnant women are not advised to look upon anything ugly or evil because, should the mother-to-be become frightened, the child will be born ugly. An eclipse of the sun or the moon should never be looked at because it may result in an infant with congenital abnormalities (for the same reason, intercourse should not occur during an eclipse since a child then conceived may also have congenital abnormalities). When an eclipse of the moon is due, an expectant mother will pick up a stone or medicinal root and place it in her pocket at the same time making a wish that she will have an easy labour. After the eclipse, she casts the stone or root away from her.

Sick persons and pregnant women must keep away from the kitchen where anything with a pungent harsh smell is being cooked (i.e., chillies, garlic or burnt fat) — the smell is believed to have a detrimental effect on their health. A pregnant woman should not have a broken comb in her hair or wear flowers in it. If she does, the amniotic sac may be very thick and she will have a difficult time pushing the baby through it at birth.

During the Water Festival in April, when it is customary for people to splash each other with water (ranging from spoonfuls of scented water to the full blast of a fire hose !), pregnant women do not have water thrown at them because of the fear of frightening them and causing harm to the baby. It is sometimes believed that a bad monsoon may follow such an act.

Expectant mothers should not go to any ceremonies such as weddings, funerals or move into a new house. A new house must be blessed and good spirits be sought to enter it but a pregnant woman is considered unclean and bad spirits may come in.

A pregnant woman should never be tapped on the shoulder because it may cause the infant *in utero* to get hiccoughs. Snakes should never be killed by women who are pregnant since it may result in the birth of a child with a peculiar tongue. It is said that if a poisonous snake bites such a woman she will never die but the infant will.

With regards to intercourse during pregnancy, there seem to be no definite ideas. In the old days, when seven months pregnant a woman would return to her mother's home for the actual delivery and would stay there for three months after it. There still is a tendency for primipara to return to their mothers for their delivery.

LABOUR

It is considered a very bad omen for the first-born to be delivered on a Saturday afternoon, and great efforts are made to avoid this happening. If it does happen the child may subsequently be given away or sold for 2—3 days. However, if either parent is a Wednesday born, it is more acceptable. This is of practical importance when planning inductions or trials of labour. There are also propitious and non-propitious days for entering hospital.

If an infant is born with the umbilical cord round or over one shoulder, or with the membranes over its face it is considered an excellent sign. There is a popularly held British belief that a boy born with a caul over his head will never drown. It is taken to mean in Burma that such a child will make a name for itself by its own efforts — the parents need not worry about it as the infant is bound to succeed in life and probably become a public figure.

In twin deliveries, the closer in time that they are born the better their chance of survival is considered to be. Should one twin die, it is thought that the other will not survive long. At birth, to prevent this in uniovular twin pregnancies, the placenta is cut into two halves and each half is buried in either side of a *chaung* (dried river bed) or a river.

The actual delivery is accompanied by considerable interference from the local midwife, the woman's mother, and her relations. As soon as the pains start a tight piece of cloth is tied above the umilicus — some local midwives do vaginal examination as well. Massage on the fundus with palms of hands or soles of feet (if there is any delay) is normal, and once the mother-to-be starts pushing, everyone starts pushing.

Massage (" to take out heat ") is used all over Burma as the first step to be taken should anyone fall ill and I have seen cases of perforated duodenal ulcers, acute appendicitis and ectopic pregnancies after they have had severe and prolonged massage. It is possible that Burmese women put up with more physical discomfort than their Western sisters since as MAUNG MAUNG (1956) writes : " The husband has the right to chastise the wife for certain improperties of conduct — for example, if any woman assumes a smiling countenance on seeing other man than her husband " — but he may not " beat her with his elbow or fists, or with a doubled rope but may whip her with a thin wand, or with the palm of his hand on the loins, buttocks or feet. "

If an episiotomy is required, the local midwife may do it with her finger nails. Should an arm prolapse during labour and delay result, the prolapsed arm may be cut off from the shoulder with a sharp bamboo in order to make the subsequent delivery easier for the mother. It is not very unusual in a country district to deliver dead babies who have limbs missing.

If the baby fails to breathe on delivery, the anterior fontanelle is blown upon. Should this fail to start respiration, the placenta is rapidly withdrawn and with cord intact and united put into a frying pan over a fire, then when the baby starts crying the cord is cut. For a retained placenta, some of the patients' hair is pulled out or cut and pushed down her throat, this makes her vomit and the placenta is expelled. (This had been performed successfully three times by one of my informants while waiting for the doctor to arrive). Alternatively, salt water may be given to the patient to make her vomit.

To help involution of the uterus, a brick is put into a fire until red hot, upon which it is picked up in tongs and dropped into a bucket of cold water to cool it slightly. It is then wrapped up in a cloth and used to massage the abdomen. This is suffered for 7 days. Postnatally, saffron is rubbed all over the body and saffron water drunk. A spicy mixture with nutmeg is also sniffed to prevent tiredness. For a perineal tear, no stitches are used. Salt, saffron, and a little spirit (often local brandy) is made up into a paste and smeared on to the tear. The woman then lies on her side and the midwife presses on her once or twice with her heel, at the same time saying " close, close ." For a big tear, the woman has to sit on a hot brick which is said to cause healing to occur. This is again suffered for seven days.

Treatment of the umbilicus is far more sanitary than in many parts of Africa. The cord is tied with three strands of twisted thread, and then cut with either a knife or piece of bamboo — scissors are not used as they are " never sharp enough. " The umbilical stump is dressed with a saffron paste and a binder put on the infant, who is bathed every day from birth.

If after childbirth, the mother does not want another pregnancy, the uterus is " displaced through the stomach. " In some way it is lifted up and twisted over to one side — it is said to be effective, but on the only occasion that I have met with this, the result was a generalised peritonitis.

On the seventh post-natal day, it used to be customary for the mother to " sweat it out " at home. She was put in a big basket with hot bricks and boiled leaves and left in it for one day to get rid of all impurities. She then bathed, washed her hair and put *thanakha* (a white powder) on her face and body, put on an abdominal binder and dressed herself up in all her finery. This was said to prevent flabby abdomens, and the mother was said to look slim and attractive after it. As one of my elderly informants (whose figure had long ago disappeared) said " things are not what they were, " but is still practiced in some parts of Burma to-day.

In the sad event of a pregnant woman dying, the baby has to be removed from the womb and buried separately — if this is not done it is bad luck and the rains may not come. Ancient Jewish teaching and a Roman law, *Rex Legia* (about 750 B.C.) ordered the same thing to be done. People do not want to live in a house where such a tragedy has occurred for fear that the infant will return and haunt the house, so that such houses may remain unoccupied for years.

Men, wearing special medals or medicinal tattoos, may not go into a room where a labour has taken place for at least 7 days — if they do they may lose their potency or " glory of manhood. " There are two distinct types of tattooing : firstly, medicinal, which consists of figures or letters on the back, chest or arms and which are frequently tattooed accompanied by special prayers against various evil spirits, snakebite, or gun and knife wounds ; secondly, decorative, which are seen commonly in the older men, who may have intricate dense patterns stretching up from the knees to the waist. Women mostly have the medicinal type of tattoo, except amongst the Chins where girls are tattooed on their face. This dates back to the days of the Burmese kings who used to kidnap Chin girls because of their outstanding beauty. Similar tattooing and deforming may be seen in Africa, where it was originally undertaken to avoid having girls stolen by slave traders. Thieves have a special cat tattoo on their thighs which are intended to help them make upward leaps of 10 feet or more when engaged in this nefarious pursuits. Men may not even visit a house where there has been a recent delivery. If such a house is visited, they must cleanse themselves with water into which a gold or silver coin has been placed, and say a special prayer at the same time. This is almost certainly based on Hinduism, where the uncleanliness of a woman who is menstruating or post-partum is much stressed.

POST-NATAL MATERNAL DIET

The most popular food is a soup called *Ringa*, made of smoked or salty fish and which is taken with plenty of pepper. This soup contains four different sorts of special leaves (including jackfruit and drumstick) and makes the patient sweat. It is also believed to help lactation to start ; for the same reason, oxtail is sometimes eaten. Otherwise there is no provision made to give the post-natal woman any special diet, although the mother does not take fresh vegetables in case that baby gets green diarrhoea.

INFANT FEEDING

Breast feeding is universal in Burma and is usually started immediately after birth. It is unusual nowadays for the colostrum to be expressed and not used, although this used to be the custom, when, for the first three days of its life, the infant used to suck pieces of muslin dipped in honey and water. It is customary for breast feeding to continue up to 2, 3 or even 4 years of age. Feeding is all on a self-demand basis and the infant may be put to the breast every half hour during the day, and during the night may sleep at the mother's side with her nipple in its mouth. There is no doubt but that the breast frequently becomes a " soother. " This has been commented upon by both MEYERS (1951) and JELLIFFE (1952) in African children.

As previously reported (FOLL, 1959), test weighing's frequently reveal that the amounts of milk sucked by the child are very small (usually 1—1½ ounces being taken at a time).

Supplementary feeding is very rare and when it is given is usually in the form of spoonfuls of condensed milk. Condensed milk is popular in tropical climates because its high sugar content makes it easy to keep, no preparation is needed for its use, and infants like the sweetness (often leading to refusal of breast milk). If bottle feeding is used, no boiling or even washing of bottles or teats is done and disaster usually intervenes in the form of gastro-enteritis. A tremendous amount of education of mothers is still required before bottle feeding may be embarked upon with any degree of safety and I consider that dried milk preparations are far better consumed by older children and their parents.

At 7—8 months, the infant may be given rice strained through muslin gauze or pre-chewed and then transferred by hand from the mother's mouth. Salt and sesame oil are often added. At one year, fish may be added to the diet. Meat is seldom given before two because there is a belief that it may cause bad teeth or worm infestation. After two years, the child may be given curry and rice, sweet potatoes but no chillies. Coffee or tea are the usual drinks, but often unboiled strained river or well water is given. Occasionally young children are given rice boiled in cows or goat's milk. Eggs are eaten throughout Burma (usually hard-boiled and chopped up) ; this is contrary to practice in parts of Africa and Malaya where it is believed that they cause worms. However, they are not usually given to children until they can speak, so that should the child be a reincarnation he can tell the parents about it. Eggs prevent these children recalling their previous existence.

Breast feeding continues as long as the child wants it or until the mother becomes pregnant again. " If the mother deprives the child of her breast the, child may lose its strength. " If the mother becomes pregnant again, *betel* juice, *mokkha* paste (very bitter) or "Tiger Balm" may be rubbed on the nipples to discourage the breast feeding child. A similar action has been described by NURGE (1957) as taking place amongst women in the Phillipines, and by JELLIFFE (1955) in India, Indonesia, Jamaica and New Guinea. It is also believed that while a woman is breast feeding her child, it offers a form of contraception, this, in spite of many examples to the contrary There is no cessation of intercourse during this time *Whilst breast feeding the mother must not eat any " hot " or " harsh " foods,* because these will effect the baby's health through the milk Wet nurses who are most often, but not always, relatives may be used

Should the mother's milk fail to come in — hot water bottles are placed on the breasts and they are massaged Depressed nipples are treated by putting them into the tip of a bottle filled with warm water, and then pulling the nipples

The old method of treating distended breasts was to rub them with saffron and then the husband, having warmed his heels in a fire, kneaded his wife's breasts with his warmed heels Nowadays it is more customary to massage with hot water There is a belief that if a woman eats rice which has a husk in it, she may develop distended breasts

It is said to be " very easy " to suppress lactation Firstly, saffron is rubbed onto the breasts, and then any key or a piece of cork is hung around the neck with the key or cork resting in the cleft between the breasts, and after three days the milk should stop If this should fail to work, an adult sucks out the milk — usually this is done by one of the mother's sisters who suck the milk and then spit it out and do not swallow it Should this fail, a puppy is put to the breasts (this is considered more effective than a sister)

SUPERSTITIONS CONNECTED WITH CHILDHOOD

Children should not be allowed out at night to play for fear that they should trip over and fall, and at the moment of falling they may be off their guards and may be entered by evil spirits which will do the children much harm If a babe in arms has been carried outside in the dark, the person carrying him must spit and stamp their foot before entering a house so that the baby may be ridded of any bad spirit it may have picked up Young babies are susceptible to bad spirits because they are so innocent , the spirit makes its presence felt by making the baby cry, stopping it sleeping and causing a fever No child should be taken up a mountain, as mountains are known to be the dwelling places of spirits or *nats*, and the child, being innocent, may be entered by a bad spirit

It is a Karen superstition that if the youngest child in the family should look backwards through his legs when standing, he is looking for a small brother or sister, and the mother will shortly become pregnant again

A double crown or " whirl " in the hair at the back of a child's head is believed to mean that the child will be extremely willful and bad tempered

SICK CHILDREN

Children with colicky pains in their abdomen are treated by chopping up a special root, mixing it into a powder, and putting it in a circle around the child's navel Another method is to grind down *betel* leaf mixed with sesame oil and then rub the mixture over the abdomen

High fevers are treated by rubbing hot shredded *betel* leaf and oil on the child's forehead (on the anterior fontanelle) or by dropping a mixture of salt and betel leaf juice into the child's eyes which cause a severe lacrimation Soot from the kitchen roof is especially efficacious for fevers, being mixed with saffron and chopped leaves of bitter coil (a vegetable) and then smeared all over the infant's body Kitchen soot is particularly good because it " contains good essences from curry, spices, etc " (it is also taken orally by adults)

Threadworms are treated by inserting into the anus, the stalk of a tobacco leaf, which calms the symptoms rather than curing the condition. Dysenteries are treated by chopped up duck's eggs, and also by garlic (burnt in hot ash) with a pinch of opium.

Conjunctivitis may be treated by putting the patient into a bath, with his feet up in the air. Water is then pured over the head and the " heat " is washed from the eyes and leaves the body via the elevated feet. A stiff neck is treated by putting a pillow in the sun, then the patient is asked to turn his head towards the stiff side whereupon he is hit seven times with the sun soaked pillow. If the youngest child in the family dies, it must be buried as soon as possible because otherwise any child born after this may suffer from the same condition and may also die, or the second child may be invaded by the spirit of the first.

The universal medicine for all ailments is a red powder called *thway-say* (literally blood medicine) — every house has a pot of it. It may be taken by mouth or sniffed. With salt it acts as a laxative, without salt it binds and with sugar it cures giddiness !

MISCELLANEOUS

A full term mummified and calcified foetus is considered to be an object that will bring much good fortune into the house and the parents will become rich. It is often difficult and in fact one frequently fails to persuade a woman who has a dead baby in her womb to come into hospital. I have seen cases where 16 months have elapsed since pregnancy started and a colleague here knows of a case of a woman carrying a calcified foetus *in utero* for 10 years. When eventually such a foetus is delivered, it is kept at home in a cot in a place of honour ; food is placed before it regularly and should any of the other children of the household be given new clothes or *panats* (sandals), the mummified foetus must be given the same, or else it will cause the occupants of the house to have bad dreams. Very rarely, indeed, does a mummified foetus bring bad luck.

The literal translation of the Burmese colloquial answer to the question " Where is your native place ? " is " My placenta (or rather umbilicus) is buried in such and such a place. " The old custom was to make a bundle of it in a rug with saffron, salt, rice and a small piece of iron and bury it on the north side of the house. The north side is the " neutral " side having no special significance. The East side represents Buddha and most houses have a shrine there, the South side faces burial grounds and the West is reserved for married couples to sleep (they should never sleep on the East side). People should sleep in bed with their heads to the East.

Placentas are meant to have considerable medicinal properties and human placentas are eaten for valvular heart diseases. Cow's placenta is eaten for asthma, and the afterbirths of cows, goats, sheep are eaten for amenorrhoea not due to pregnancy.

CONCLUSION

In conclusion, it must be realized that many of the customs and superstitions mentioned and that many of the obstetrical manoeuvres described are either things of the past or only occasionally occur now in rural areas. Great strides are being made to-day in Burma with Maternal and Child Health Services, and the standard of midwifery and infant care is being daily raised. However, before the full force of scientific medicine reaches Burmese children, it is as well that there should be a clear understanding of some of the thoughts that may be going round inside a worried parents head.

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OBSERVATIONS ON THE GROWTH OF CHILDREN IN NSUKKA DIVISION, EASTERN NIGERIA

by

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This paper describes a cross-sectional study of the heights and weights of 446 children in Nsukka Division in Eastern Nigeria, which is essentially a rural area with a population of about 500,000 and an area of 1,314 sq miles The people live mainly in villages scattered over this area of forest land Farming is the main occupation

There appear to be no particular food taboos during pregnancy, but there is a widespread belief that there should be a reduction in the intake of animal protein during the latter months of pregnancy in an attempt to prevent the newborn baby from being unduly large, which is thought to lead to a difficult labour

Children are not usually given meat or other animal protein foods Breast-feeding usually continues up to about 2 to 3 years of age Supplementary feeds during the period of infancy include hardly any animal protein foods This is in keeping with the cultural pattern of the vast majority of people in the rural areas of Eastern Nigeria Milk is not available Eggs are plentiful, but not often eaten either by children or their parents, since these form a valuable economic asset The people, however, consume a large variety of beans, green vegetables and fruits

Varying degrees of undernourishment in children, particularly during the weaning period is fairly common, but no case of kwashiorkor was seen during this study of 446 children which was carried out between November, 1956 and May 1957

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* I am indebted to the Director of Medical Services, Eastern Nigeria for permission to publish this paper

The health facilities in this area consist of a number of local health centres, each with an infant welfare clinic which is a part of the maternity and child welfare unit of the health centre.

METHODS

Birth weights, together with rate of growth during infancy and childhood, form data for assessing the progress of maternity and child welfare programmes in any area. Where these do not already exist, it is important to attempt to obtain them. This paper describes one such attempt in Nsukka Division.

The difficulties encountered in carrying out such studies are many. These include the use of adequate weighing scales and measuring instruments, uniformity in the procedures used and the availability in one centre of a sufficient number of infants.

In order to get a fairly large number of children below 12 months of age, it was decided to work in six local health centres. The weighings and measurings were done in most cases by the author and assisted by the staff of the clinics. These were carried out every two weeks in each centre.

A uniform set of weighing scales available at each centre was used. These were of the spring-balance type, with a receptacle on the top for the baby to lie on, and a pointer and dial for reading off the weights. These scales were adjusted with standard weights of 1 lb., 2 lb. etc., before each weighing session. On this pre-testing depended to a large extent, the degree of accuracy achieved in each centre, and the uniformity in the reading of the weighing machines in all the centres. The double beam counter-balancing type of weighing machine was not available at Nsukka during the period this survey was undertaken.

The apparatus used for linear measurements consisted of a plastic tape measure, a sliding foot-board and a fixed board for the head to rest against. These were mounted on the top of a table. The recumbent length (crown-heel) was the linear measurement taken.

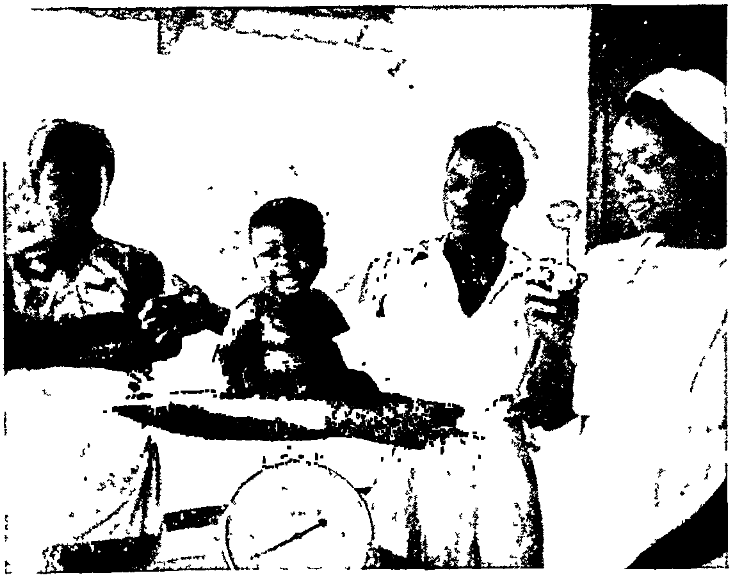

FIG. 1. Weighing infants, showing type of balance used.

FIG. 2. Examination of infants including abdominal palpation for splenic enlargements.

196 newborn babies in the six centres born between November 1956 and April 1957, were followed up by fortnightly weighing and measuring up to May 1957. The remaining 250 infants of varying ages attending the infant welfare clinics were also weighed and measured fortnightly during this period. The ages of these 250 infants, which varied between 1 month and 12 months, were accurately ascertained since 92 per cent. of them were born at the Maternity Homes of the six local health centres, where a record of their birth weights were kept as a normal routine.

Weighing and measuring was done only after the children had been stripped of all clothing. Newborn babies were weighed within 24 hours of birth, their linear measurements were not taken.

ANALYSIS OF RESULTS

Birth Weights

The average birth weight was calculated as the arithmetic mean of the birth weights of the 196 neonates of both sexes born in the six health centres between November 1956 and April 1957. This came to 6 lbs. 4 oz. with a variation of ± 16 oz. for 70 per cent. of the series. The range was from 5 lb. 2 oz. to 7 lb. 8 oz Twins were not included, and the series was not restricted to first-borns, as is usual in studies of this type. Males and females were grouped together. The figures obtained at Nsukka were compared with similar figures at Aba.

Aba is an urban town with flourishing markets and growing industries. In the Aba series of 94 birth weights, the arithmetic mean came to 6 lb. 6 oz. with a variation of ± 16 oz. for 70 per cent. of the series. The range was from 5 lb. 2 oz. to 7 lb. 10 oz. The Aba series, like the Nsukka one, was an unselected group. This was obtained by collecting 94 case notes of normal deliveries in the lying-in wards of the Aba Maternity Hospital and working out the arithmetic mean from these figures. Twins were not included, and the number was not restricted to first born babies. Males and females were grouped together.

These average birth weights are below the usual figure of 7 lb. for the U.K. and above the figure of 6 lb. 1 oz. that has been given for India. Several reasons are usually put forward to explain these differences, including genetic differences and an inadequate diet during pregnancy.

TABLE I. Mean weights and heights during first year of life.

Age in months	*Weight* lb.	oz.	*Standard deviation* ozs.	*Height in inches*	*Standard deviation* inches
1	8	0	18	19.5	0.6
2	10	4	20	20.9	0.9
3	12	2	22	21.5	0.8
4	13	8	24	22.8	0.9
5	14	2	24	23.7	0.9
6	✓15	4	✓26	✓24.5	✓1.0
7	16	2	30	25.2	1.1
8	16	12	32	25.6	1.1
9	17	5	30	26	1.25
10	17	12	36	26.3	1.25
11	18	0	36	26.5	1.2
12	18	6	38	26.75	1.1

Growth during infancy

Table I shows the mean heights (recumbent lengths) and weights of singleton infants (first borns and others) of both sexes, grouped together during the first twelve months of life (cross sectional data).

After the initial loss in weight during the first few days of life due to dehydration etc. the infants gained on the average 9 *lbs. during the first six months* of life. A normal infant weighing 6 lbs. 4 oz. at birth, might be expected to weigh 15 lb. 4 oz. at six months of age. During the second six months the weight gained is much less than that gained during the first six months. It is approximately one-third i.e., 3 *lb.* The total gain over the first twelve months comes to 12 lb. A normal-infant weighing 6 lb. 6 oz. at birth is expected to weigh 18 lb. 6 oz. at twelve months. These respective gains of 9 lb. for the first 6 months and 3 lb. for the second 6 months of life are below the U.K. standards of 10 lb. and 5½ lb. respectively (ELLIS, 1954).

Besides hypothetical racial genetic factors, one of the main reasons for this reduced rate of growth particularly during the second semester of life is the fact that the infants at Nsukka take hardly any animal protein in their supplementary feeds.

Another possible reason might be the almost universal chronic malarial infection in the area. 52 per cent of the 446 infants in this series had spleens enlarged up to half way between the umbilicus and the xiphisternum. Dr. L. J. BRUCE-CHWATT's results of a spleen and parasite survey in Nsukka Division gave an average of 58 per cent. (47 infants out of 81) of infants with spleens enlarged up to midway between the xiphisternum and the umbilicus. The crude parasite rate in his series was 93.6 per cent. and the parasite density for *P. falciparum* was 4.23 (BRUCE-CHWATT, personal communication).

The majority of children with spleens of this size were persistently below the mean height and weight for their age. They had to be included in the series, since malarial infection could be regarded as a "normal" occurrence for infants in the rural areas of Eastern Nigeria

In the Nsukka series, the weight gained during the second 6 months is only 33⅓ per cent of that gained in the first 6 months The weight gained by infants in Britain during the second 6 months is a little over 50 per cent of that gained in the first 6 months

DISCUSSION

In considering growth of infants, it must be clearly understood that each child sets his own standard There should be no undue insistence on exceeding a rigid growth pattern Any "mean" arrived at for any country is merely a rough average A child whose growth is, over a period of time, outside the standard deviation for his age group calls for a close follow-up

Measurements carried out on stratified samples of healthy children in successive age groups have served to show the mean and the variation of each measurement selected at each age (ELLIS, 1954) The standards provided by cross-sectional data are sometimes described as distance standards

In comparing an individual child with the mean measurement at his own age, the variation or scatter of the sample from the mean has to be taken into account If this is done, one can determine where the child lies in relation to a group of healthy children of the same age

A cross-sectional, as opposed to a longitudinal, growth study is described in this paper When there is no doubt regarding the ages of an unselected group of children, and the instruments used are reliable for ascertaining their weights and linear measurements, the results of cross-sectional growth studies can be fairly reliable

A longitudinal study is the ideal It involves following up the same group of children from birth, through infancy, childhood and adolescence until growth ceases after about the 18th-20th year of life Such studies have been carried out in some Western Countries, particularly in North America They are at present being done in India and other Asian countries There is equally a great need for such investigations to be undertaken in West Africa

SUMMARY

The results of a cross-sectional study of the heights and weights of 446 infants in Nsukka Division of Eastern Nigeria have been reviewed in this paper The average birth weight for the Nsukka series is 6 lb 4 oz with a variation of ± 16 oz for 70 per cent of the series This figure is below the U K standard of 7 lb and above the Indian figure of 6 lb 1 oz The gain in weight over the second six months of life is only one third of the gain during the first six months, this is 3 lb and 9 lb respectively The U K figures are 5½ lb and 10 lb respectively Lack of adequate protein supplementary feeds and a high incidence of malarial infection have been suggested as reasons for this much reduced gain in weights during the second six months of life

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CORRESPONDENCE

To the Editor

SIR,—In your issue of March, 1958, (Vol. 3, p. 167) Drs. C. G. WILLS and J. C. WATERLOW have suggested " that the crude death rates between 1 and 4 years may be used, as a first approximation, as an index of malnutrition, even though malnutrition as such may hardly figure in the listed causes of death."

There is much to justify such a conclusion and these figures are being quoted and used by other workers (i.e. F.A.O. in " The State of Agriculture in 1958 " p. 124 ; J. McFie in " Malnutrition in Uganda " *Lancet*, 1959, p. 61). Nevertheless, I think some caution should be adopted before this method of reckoning is adopted.

In the first place, the diagnosis of malnutrition may be a rash one, if it is to be understood as primary malnutrition due to feeding defects. Many of these children die with multiple diseases which form a vicious circle. How much the diarrhoea is due to the malnutrition or the malnutrition due to the diarrhoea is exceedingly difficult to say except by watching the episodes of illness through which the child passes.

If the records are examined more closely, it will be seen that probably less than half of these children have been seen by a doctor, and that a doctor's certificate may only mean that they have attended hospital sometime within two months of death. Most of them are malnourished when they die, but is it justified to say that they have died of malnutrition ? It is better to ignore the diagnosis rather than to draw unjustified conclusions. As it is, there is much danger that a high child mortality will be treated with skimmed milk rather than the improved pediatrics and medical care which are so badly needed. There is no short cut to better statistics except better observation.

The other objection to the figures given in this paper is the attempt to relate the 1-4 year mortality to the number of live births. This would seem to introduce a new possibility of error. It gives no figures comparable to those for technically developed countries where, in the International Demographic Yearbook, the number of deaths in the 1—4 and older groups is given per 1000 living at that age. Where there is a high infant mortality and a high mortality in the 1—4 year group, there will be fewer older children at risk and the figures will give a false picture.

A simple and dramatic, yet accurate, method of presenting the situation is given by F. A. E. CREWE, (*East Afr. med. J.* 1957, 34, 487), when he gives the deaths under 5 years as the percentage of total deaths. In Sweden the deaths under 5 years amount to 4.5% whereas in Mexico they are nearly 50%.

The authors also state that " it is reasonable to suppose that errors in *death* registration will be comparable in the two age groups." But in many countries it has been found that the younger baby at death, and the further the registration office, the less likely is birth *or* death to be registered. In my experience this is true of Jamaica.

The authors are quite right when they say that " the nature of the statistical classifaction that is used in official tables tends to obscure the part played by malnutrition." This is perfectly true. The present classification of nutritional diseases in the International list is deplorable and urgently needs revision, and so is the classification of diarrhoeal diseases. It is still more essential to improve the facilities for the diagnosis and treatment, and hence of prevention, of disease in children.

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The JOURNAL *of*
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EDITORIAL

COMMUNICATION IN TROPICAL PEDIATRICS

All health workers in tropical countries are deluged with an often ever-swelling flood of day-to-day activities, while, at the same time, they often tend to become both geographically and intellectually isolated from recent ideas and methods, even in dealing with particular problems which are important to them.

This is certainly often true for the tropical pediatrician who may not always be aware of the practical application of research work carried out elsewhere in the world, or, not rarely, in centres in his own country.

As with so much of tropical pediatrics, a failure of communication is responsible. In this case, not between pediatrician and indigenous mother or community, but between the research centre where investigation is being carried out and the bulk of a medical service working in peripheral or field hospitals and units.

It is this apparent need which has been responsible for the note in the present issue on protein-calorie malnutrition in early childhood, which, it is hoped, may be the forerunner of further similar publications in this " Practical Notes " series on other major topics in tropical pediatrics.

It is realized that the article in the present issue is orientated towards ecological conditions in East Africa, and, indeed, this is its purpose as the Uganda Medical Service has agreed to circulate reprints widely as a guide to medical officers, nursing sisters and medical assistants in the country.

There is little doubt that this improved communication of knowledge is needed in many countries. Stories of children with kwashiorkor mistreated with mercurial diuretics or with repeated doses of toxic anthelminthics, such as oil of chenopodium, can still be heard in rural areas in some countries in various parts of the world.

As well as health education of the community at large, it is clear that the constant bringing up-to-date of medical personnel must comprise an integral part of active, modernizing child health services.

HAEMOGLOBIN LEVELS OF SCHOOLCHILDREN IN A RURAL HEALTH DISTRICT OF MALAYA, AND OF PREGNANT WOMEN IN MALAYA AND SINGAPORE

by

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and

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It is common clinical knowledge that anaemia, often of severe degree, is prevalent in Malaya and Singapore Surveys show that in some communities haemoglobin levels are far below that regarded as normal (LAMPRELL and CHEEK, 1952) Because of tne importance of the problem many more surveys are still required to determine its precise extent Further information of haemoglobin levels of schoolchildren is given in the present paper Some observations on pregnant women are included, and may be of interest in the present context

Schoolchildren The haemoglobin levels of 261 boys and 174 girls were determined These children attended six different schools in the Muar Rural Health District (GRANT, WADSWORTH and TAN, 1959) Four groups were Malays and two were Chinese The parents were engaged for the most part in rubber tapping and all belonged to the lower income group

Pregnant women Ninety-eight of the women were examined at the ante-natal clinic at Muar and were mostly Malays and Indians, with a few Chinese Another group of 86 were the wives of Malay soldiers, and they attended the Army clinic in Singapore The remainder were 24 patients in the ante-natal ward of the General Hospital, Johore Bahru Most of the last group were known to be anaemic

METHODS

Capillary blood samples Estimations of haemoglobin in the case of the children and pregnant women in Muar were made on capillary blood A finger tip, cleaned with alcohol, was firmly held and pricked sharply by means of a cutting needle previous passed through a flame In nearly all instances a free flow of blood was obtained , but in a few cases where a child appeared to be afraid some difficulty was encountered No such difficulty occurred in any of the women

The blood was immediately taken up into an " automatic " 0 02 ml pipette and ejected with repeated washing into 4 0 ml of 0 04 per cent ammonia solution, contained in a ' bijou " bottle fitted with a screw cap After preparation of the oxyhaemoglobin solution the bottle was tightly closed and stored away from the light Readings were taken in an MRC Grey Wedge photometer within a few hours Such treatment does not lead to appreciable change in the colorimetric property of the solution (WADSWORTH and LEE, 1955)

The photometer was calibrated against a Unicam SP 600 spectrophotometer of known accuracy (WADSWORTH and LEE, 1959) The same 0 02 ml and the same 4 ml pipette were used for calibration and throughout the survey A consistent error of +4 per cent Haldane scale over a range of 23 0 per cent to 108 5 per cent was found, and this amount was therefore deducted from all observed readings The experimental error of the method was determined as previously described (WADSWORTH, 1955) and it was found that there was a mean difference between duplicates of 1 3 per cent Haldane scale, and that observed differences of more than 2 2 per cent Haldane scale were statistically significant

Venous blood samples In the case of the Singapore and Johore Bahru pregnant women oxalated or heparinized venous blood samples were used In addition to haemoglobin concentration, packed red cell volumes were also determined For the latter purpose blood was centrifuged at 3000 r p m for one hour in Wintrobe tubes. Haemoglobin was estimated as oxyhaemoglobin, 0.1 ml. of blood being added to 20 ml. of ammonia solution. The accuracy of the spectrophotometer had been verified (WADSWORTH and LEE, 1959) and that of the micropipette was known.

TABLE I. Haemoglobin levels in Muar schoolchildren.

Age (years)	Number	Mean Hb. conc'n. % Haldane scale	gm./100 ml.	Std. Devn. % Haldane scale
Boys				
7	42	78.9	11.8	5.4
8	24	78.9	12.0	4.7
9	27	83.4	12.4	6.2
10	37	82.3	12.3	6.7
11	36	84.2	12.5	7.3
12	32	84.1	12.5	6.6
13	27	86.6	12.9	4.6
14	20	87.5	13.0	5.9
15	12	89.3	13.3	5.4
Girls				
6	15	80.0	11.9	5.1
7	23	80.3	12.0	6.5
8	20	81.8	12.1	6.0
9	30	82.2	12.3	5.9
10	25	85.6	12.7	6.1
11	20	83.0	12.4	6.2
12	14	85.7	12.7	7.1

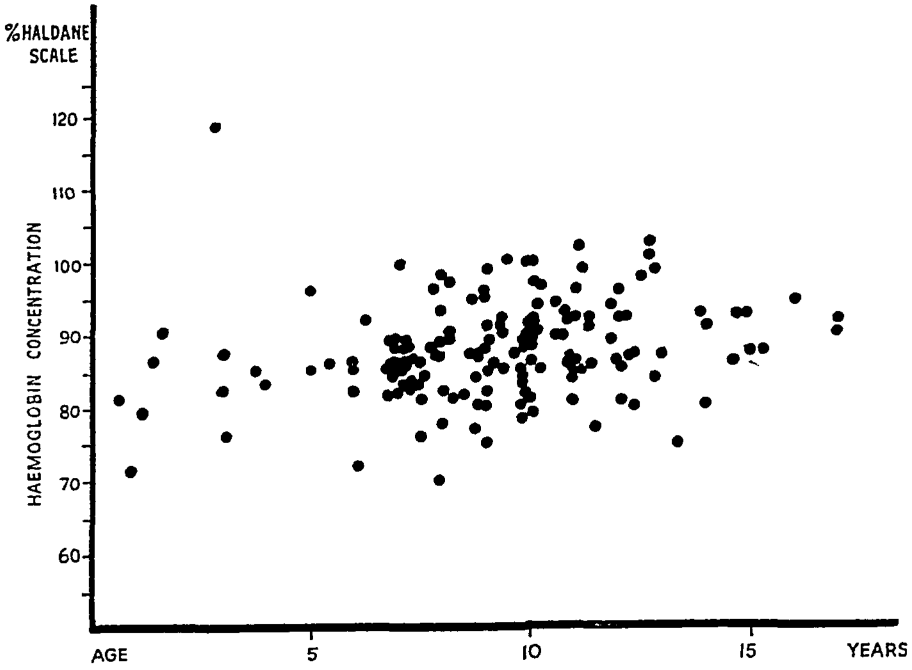

FIG. 1. Haemoglobin concentrations, Muar girls.

RESULTS

Schoolchildren Haemoglobin levels are shown in Table I and Figs 1 and 2 In the table some age groups are omitted because of the small number of subjects

Pregnant women. The haemoglobin levels of the pregnant women in Muar were analyzed according to the duration of pregnancy (Table II) and to parity (Table III)

Haemoglobin level and Mean Corpuscular Haemoglobin Concentrations (MCHC) for wives of Malay soldiers are given in Table IV

Details of parity and duration of pregnancy were not available so the group was treated as a whole There were 30 per cent of women with haemoglobin levels below 10 5g /100 ml and 7 per cent with MCHC less than 30 7 per cent

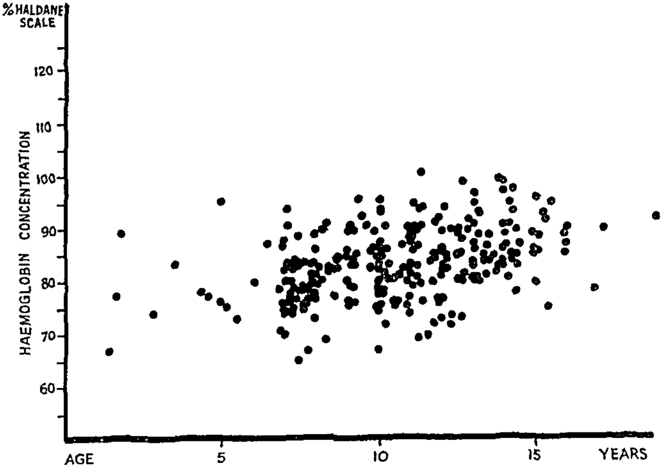

FIG 2 Haemoglobin concentrations, Muar boys

TABLE II Haemoglobin levels in pregnant women in Muar according to duration of pregnancy

Duration of pregnancy (months)	Number	Mean Hb % Haldane scale	Std Dvn	Range
less than 4	6	66 6	10 7	41 8–77 8
4	8	66 9	5 6	55 5–73 0
5	11	69 3	6 7	56 0–81 5
6	21	69 6	7 2	51 0–82 0
7	18	68 8	6 2	51 0–79 0
8	16	71 8	7 3	55 5–88 0
9	15	73 7	3 1	67 8–81 5

TABLE III. Haemoglobin levels in pregnant women in Muar according to parity.

No. of previous children	Number	Mean Hb. % Haldane scale	Std. Dvn.	Range
0	18	71.6	4.8	55.5–79.5
1	12	71.4	3.2	64.3–78.0
2	11	70.8	4.4	55.5–81.5
3	12	72.6	8.6	62.3–81.5
4	10	69.7	5.3	47.8–79.8
5	11	69.9	8.2	51.0–82.0
6	6	68.2	9.9	56.0–88.0
7	6	67.5	4.5	62.0–73.0
8	6	64.5	7.8	51.0–75.2
9	1	76.0	—	—
10	2	58.5	—	57.0–60.0

TABLE IV.

Number	Mean Hb. g./100 ml.	Std. Devn.	Range	MCHC %	Std. Dvn.	Range
84	10.9	1.9	4.5–14.4	33.7	1.7	26.0–37.2

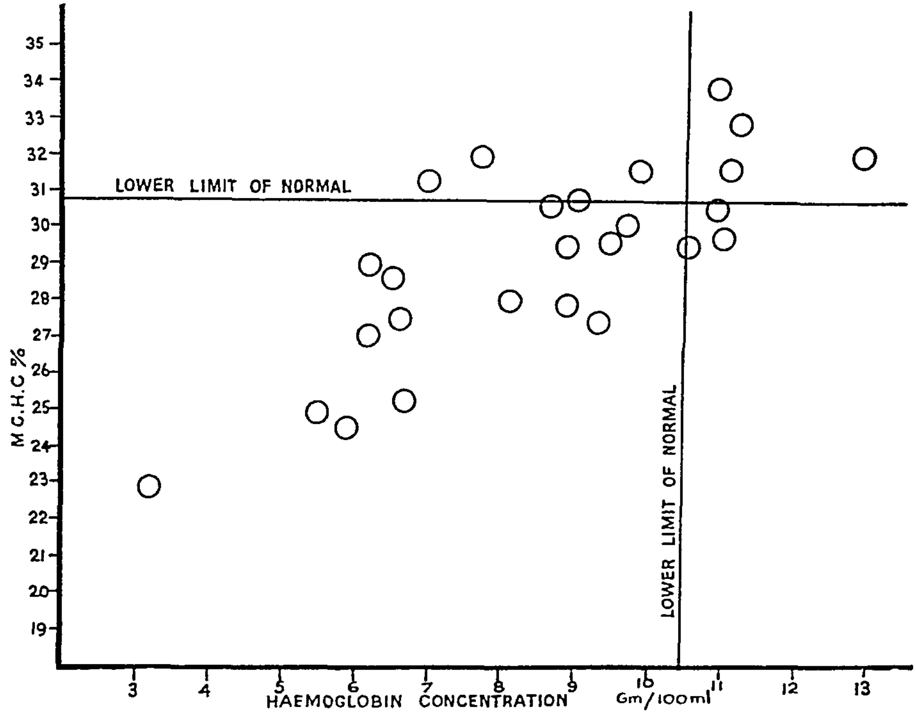

FIG. 3. Haemoglobin concentrations and mean corpuscular haemoglobin concentrations in a group of anaemic pregnant women.

In Johore Bahru only anaemic inpatients were selected and details are given to indicate the kind of anaemia present MCHC and haemoglobin concentrations are shown in the scatter diagram (Fig 3) It will be seen that the lower haemoglobin levels were usually associated with a correspondingly low MCHC, that is to say, the anaemias were mainly hypochromic

DISCUSSION

Whilst throughout the body growth period there is a progressive increase in the total number of red cells and haemoglobin in the body (KARLBERG and LIND, 1955 , OSGOOD, 1955), concentration of haemoglobin in the peripheral blood varies (GUEST and BROWN, 1957) At birth very high values are found which fall sharply during the first three months of life (GUEST and BROWN, 1957) Thereafter they show a gradual rise until puberty when levels in males continue to increase for some time, whereas those in females show, if anything, a slight fall (HAWKINS, SPECK and LEONARD, 1954) Up to the onset of puberty there is little difference between haemoglobin levels of boys and girls

Owing to individual variation, there is in presumably healthy children a range of haemoglobin concentrations of about 11 to about 16 g /100 ml (HAWKINS, SPECK and LEONARD, 1954) i e 74-107 per cent Haldane scale PETT, HANLEY and PERKINS (1946) and PETT and HANLEY (1947), however, found in children a lower limit of about 80 per cent Haldane scale This is in agreement with the range of values found in English children by BERRY, COWIN and MAGEE (1952) Judged by this standard a considerable number of children in the present survey were anaemic This is also suggested by the mean values which are appreciably lower than those for English schoolchildren (BERRY, COWIN and MAGEE, 1952)

The well-known haemodilution which occurs in pregnancy leads to a fall in haemoglobin concentration compared with those of non-pregnant women However, mean values do not commonly fall below 70 per cent Haldane scale in ante natal patients in England and America (DAVIS and JENNISON, 1954 , HOLLY, 1955 , RAMSAY and WADSWORTH, unpublished observations), and there is a gradual increase at the end of pregnancy When iron is given haemoglobin levels are maintained well above 70 per cent Haldane scale (HAMILTON and PAYLING WRIGHT, 1942) It is reasonable, therefore, to set an arbitrary lower normal limit of 70 per cent Haldane scale Of the Muar subjects 42 per cent were anaemic on this standard One third of the wives of Malay soldiers had haemoglobin levels below 70 per cent Haldane scale (10 5 g /100 ml) However, only 7 per cent in this series had an MCHC of less than 30 7 per cent which is a lower arbitrary normal limit suggested by Simpson (1954) Among the Johore Bahru inpatients over 61 per cent had an MCHC of less than 30 7 per cent This suggests that among the subjects attending clinics but not regarded as anaemic, simple haemodilution may have accounted for some of the low haemoglobin levels (SIMPSON, 1954)

When a normal person moves suddenly from a cool to a hot climate the haematocrit may fall from a usual level of about 46 per cent to 33 per cent, but this effect only lasts a few days (WADSWORTH, personal observation) Such temporary haemodilution has been shown by others (BARCROFT et al , 1923 , POST and SPEALMAN, 1948) However, continued residence in a tropical climate does not normally seem to be associated with low haemoglobin levels (LEHMANN, 1949 , WADSWORTH, 1953) Nevertheless, not enough is known about the effect of climate on the physiological haemodilution of pregnancy and during growth, and in the present study excessive haemodilution cannot be excluded as a cause of at least some of the low haemoglobin levels which were found. On present knowledge, however, it must be concluded that a considerable amount of moderate anaemia exists among children in Muar and in pregnant women in Malaya. Such degrees of anaemia should not be regarded as unimportant (WADSWORTH, 1959) because they may lead to deleterious effects in the course of time, and account for loss of physiological efficiency (CULLUMBINE, 1949) and possibly for a number of symptoms of ill-health (JUDY and PRICE, 1958).

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NITROBENZENE POISONING IN INFANTS DUE TO INUNCTION WITH FALSE BITTER ALMOND OIL

by

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Amongst the benzene derivatives, acetanilid is the one that has a therapeutic application being used as an analgesic Some of the other derivatives come in contact with the body surface accidentally and are liable to cause poisoning, e g , aniline and nitrobenzene In the body these are changed to para-aminophenol, which is probably a therapeutic and toxic agent (NELSON, 1954) Acetanilid and aniline poisoning can occur when exceeding the therapeutic dose , while aniline poisoning occurs in newborns and older children from dye materials stamped on diapers and laundry if these remain in contact with the skin for sufficient time Paranitraniline is found in some wax crayons that may be ingested by babies Black shoe-dye containing nitrobenzene has produced poisoning in older children, when shoes recently dyed black have been worn for hours It seems that it is quite sufficient for the fumes to come in contact with the skin for poisoning to take place (BRENNEMANN, 1949)

The signs and symptoms of acute poisoning by different benzene derivatives are almost identical Early cyanosis due to methaemoglobin formation is a constant feature The functional anaemia produced leads to anoxia, weakness and sometimes dyspnoea Circulatory failure and shock may occur In some cases, excitement followed by depression takes place Skin reactions, such as urticaria and erythema, are sometimes present

In Egypt, pure bitter almond oil is often used by some mothers to rub babies, in an attempt to remove crusts from the skin and to protect or cure the child from a variety of other diseases, such as napkin dermatitis, stomatitis, diarrhoea, vomiting, etc

CASE REPORTS

The first observation of a case of nitrobenzene poisoning was made in 1949, when a newborn was brought to Alexandria University Children's Hospital with the tentative diagnosis of cyanotic heart disease The mode and time of onset, together with a complete absence of other suggestive signs, made the possibility of this diagnosis very remote The mother, during history taking, said that the child was rubbed with bitter almond oil for the treatment of a recent napkin rash The baby recovered from the cyanosis in 24 hours before any investigations could be carried out

Following this, a few similar cases have been admitted to the hospital each year, with the usual story of the baby having turned blue, after having been rubbed with the supposed bitter almond oil

Blood samples have been secured from 15 cases and when examined with the Beckmann quartz electrospectrophotometer, they showed maximum absorption at wave-length 630, characteristic of methaemoglobin.

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* I am grateful to Professor A S Abbassy, Head of Department of Pediatrics for revising this paper, and to Dr M M Taha Assistant Professor, Biochemistry Department, for the electrospectrophotometric detection of methaemoglobin

On one occasion, in 1953, an infant of 11 weeks, a son of a chemist, was rubbed with supposed bitter almond oil and became cyanosed. The father being on the staff of the Pharmacology Department suspected nitrobenzene poisoning after noticing its strong smell. The remaining amount of the oil from the home, and a sample collected from the shop, were taken for analysis. Using the technique of RIEDAL et al. (1955), nitrobenzene could be easily detected in both specimens.

Further samples from other cases were examined in the same way and it was found that the so-called bitter almond oil is nothing but a mixture of nitrobenzene (2-10 per cent) and cotton-seed oil (90-98 per cent).

CLINICAL DETAILS

Twenty-one affected infants have been seen, 15 males and 6 females. Their ages varied between 15 days and 6 months. Twelve were either newborn or below one month of age ; 8 were between one and two months, while only one child was six months old. The weights have been consistent with the age, with a tendency to be towards the lower limit of normal in most instances.

The appearance of cyanosis was reported to have taken place between four hours and four days after the application of the false bitter almond oil. In 70 per cent of the cases, cyanosis was noticed by the mother within 24 hours after the application and in 95 per cent it was noticed during the first forty-eight hours. In the remainder, cyanosis was observed later than two days after inunction.

The time between the appearance of toxic signs and admission to hospital varied between four hours and two weeks. most of the cases came to hospital within 24 hours of appearance of signs, particularly cyanosis. On admission to hospital, 4 infants were in good general condition, 11 moderate and 6 bad. The latter were in a state of shock with cold extremities and a rapid pulse. They were either drowzy or semicomatose. The two deaths of the whole series were among this group.

Cyanosis of moderate degree was noticed in the majority (15) of the cases ; the remaining six showed intense cyanosis, together with impairment of consciousness, irregular slow respirations, inability to suck and signs of collapse. The temperature was normal in 16 infants, four showed some pyrexia on admission (38-38,5°C) and one case was hypothermic. Nine cases showed some abnormality of respiration, either a slowing or irregularity that sometimes amounted to Cheyne-Stokes pattern.

Apart from the changes in respiration and pulse, the heart, chest, abdomen and nervous system showed no abnormality. Associated conditions were met with in most children. Six had diarrhoea, with or without vomiting and flatulence, four had thrush stomatitis, two napkin dermatitis, one nasopharyngitis, one bronchitis with a rise of temperature and one was markedly wasted. These associated conditions were either present on admission or developed during the stay in hospital, which varied between one to 10 days, with an average of three.

Nineteen children recovered completely and were discharged with no or very mild residual cyanosis. Two cases died, one aged two months and the other 16 days old. Both were undernourished and in a bad condition on admission, with intense cyanosis, drowziness and shock, vomited many times and had Cheyne-Stokes respiration. Both developed terminal broncho-pneumonia.

TREATMENT

The rule was to wash the body thoroughly to remove the remaining oil on the skin Shocked children were treated with warmth, oxygen inhalation and stimulants, such as nikethamide

Methylene blue was given orally in a 5 per cent solution in a dose of 5 mg /kg /day or in a 0 5 per cent solution in a dose of 1mg /kg/day intravenously The intravenous dose was usually given only once, while the oral therapy was continued for 24-48 hours There was no difference in the recovery rate between cases given oral or intravenous therapy

Vitamin C in a dose of 200 mg /day was given almost as a routine, and blood transfusions were undertaken for the severe cases, including those in shock

In the moderately severe cases, methylene blue and vitamin C were all that was required Chemotherapy, antibiotics, vitamin B complex, and local applications to the skin and mouth were given according to the requirements of the associated complaints

DISCUSSION

There are a few reports in the literature of nitrobenzene poisoning that have occurred accidentally when it was given instead of bitter almond oil (LEADER, 1932)

Unfortunately nitrobenzene oil is sometimes called " artificial oil of bitter almonds ' The confusion being due to the indentical smell of nitrobenzene and the hydrocyanic acid contained in bitter almond oil

This substitution is resorted to in our cases because the genuine product is expensive and a small percentage of cheap nitrobenzene added to cotton-seed oil will give the same smell and consistency as bitter almond oil (RIEDAL et al 1955)

Recovery has been the rule, including some of the babies who were admitted to hospital in a bad general condition Both fatal cases were in underweight infants, who developed bronchopneumonia prior to death

After the cause of poisoning has been discovered, we made the cases notifiable to the police authorities, and the seller had to go through an inquest

SUMMARY

Twenty-one cases of nitrobenzene poisoning due to inunction of infants of false bitter almond oil are reported The clinical picture is described and prognosis and treatment are discussed

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BOOK REVIEWS

Child Welfare in Africa south of the Sahara. Report of a Symposium organized in Lagos, Nigeria in March 1959 by the International Children's Centre and C.C.T.A. 1959. Paris : International Children's Centre.

This well produced publication gives a bilingual account of the 1959 Lagos meeting. The programme had been arranged under three interesting headings — (1) the adaptation of the child to the social evolution of his country, (2) sanitary education and propaganda for the public in regard to the problems of maternity and childhood, (3) feeding and nutrition.

As always the quality of the papers varied greatly and some suffer by translation. However, the net is very widely cast ranging from the child of leprous parents and juvenile delinquency, to the use of the Rorschach test and methods of infant feeding.

As is usual with this type of meeting, few questions are solved, but the stimulus of various minds brought to bear on problems is extremely helpful. This report should be available to all those working in the field of tropical child health, whether their interests be with physical or social needs.

Iron Deficiency Anaemia. Report of a Study Group. WHO Technical Report Series No. 182. 1959. WHO : Geneva. 1/9d.

This small booklet is of great interest, largely because it emphasises the quite recent realisation that iron deficiency anaemia is common in many tropical regions where iron intake is apparently adequate. Its relevance to the tropical pediatrician is clear.

Proteins in Foods. By S. Kuppuswamy, M. Srinivasan and Subrahmanyan, Indian Medical Research Council Special Report Series No. 33. 1958. New Delhi : Wesley Press, Mysore City. Rs. 12.

This monograph represents a very great amount of hard work and will be of real practical value to those concerned with problems of kwashiorkor and like conditions. The authors have collected and collated information concerning the proteins of foods used all over the world. A glance at the index reveals the width of their scope, including as it does camel's milk, rhubarb leaves and sparrows, as well as the more normal items.

There is, however, no mention of the various insects eaten in Africa and elsewhere. This is a minor criticism of what is a valuable piece of work, in which also can be found available information concerning digestibility, processing, supplementary value and so on.

Les Problèmes de Protection Maternelle et Infantile au Congo Belge et au Ruanda-Urundi. By M. Vincent. 1959. Bulletin No. 2. Brussells : FOREAMI.

The quickening pace of interest and of activity in the wide field of pediatrics in Africa (as mirrored by the new " African Child Health " section in the present issue of the Journal) is well exemplified in this monograph.

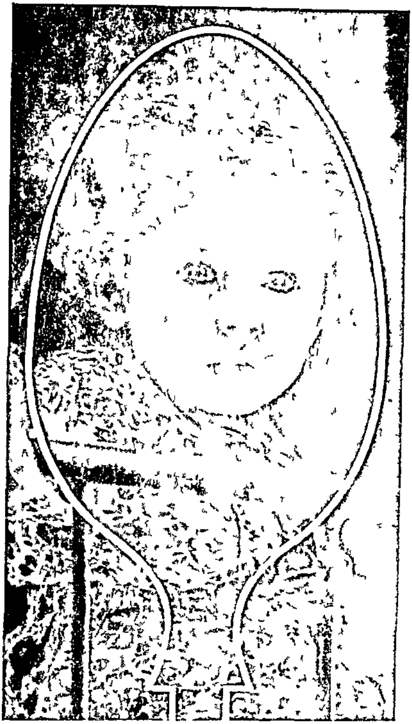
The author, Dr. Marc Vincent, has had wide experience in the field of MCH and the main theme of his book is the usual one of how to do a great deal with limited staff, facilities and money, and, in particular, the problem of priorities. His views are well worthwhile reading.

The changing orientation that is coming about in Africa is shown by two sections ; one on orphans and the other on children of leprous or tuberculous parents.

A Manual of Pediatrics for South-East Africa. Edited by P. Robinson. 1959. Bombay : Orient Longmans. Rs. 7.50.

As is the way with composite publications with multiple authors, the level of this book varies greatly. Particularly useful chapters are those on iron deficiency and the newborn. However, there are also certain places where the emphasis is incorrect — in particular the fleeting mention of kwashiorkor, the most important problem of tropical pediatric nutrition ; while some sections contain what is probably incorrect information, such as the advice to breast-feed 3 hourly or the statement that the whipworm lives in the small intestine. The photographs are of variable quality.

However, the book has, as the Editor remarks, two aims. Firstly to cover in a practical fashion the main diseases of children in South-East Asia, both so-called tropical and cosmopolitan, and, secondly, to stay within a reasonable cost. In both of these, the Editor has succeeded and, together with the publishers, is to be congratulated.



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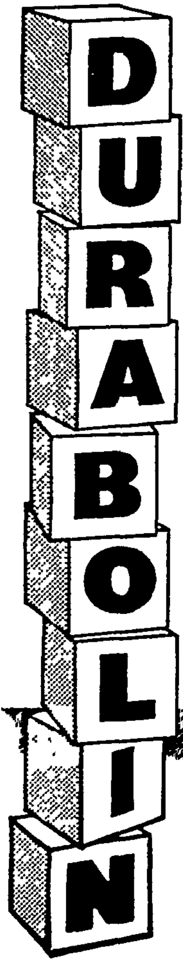

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African Child Health

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AMOEBIC LIVER ABSCESS IN INFANCY*

by

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Although amoebic liver abscess in infants and young children is uncommon, it occurs all over the world as witnessed by the reports of one or two cases from Southern Rhodesia (Osburn, 1944), South Africa (Chatgidakis, 1953), the Philippines (Tupas et al , 1951), Italy (Gerbasi, 1941), Algiers (Le Roy des Barres, 1930 and Payet, 1950), Egypt (Debbas, 1953) and America (De Bakey and Ochsner, 1951) Some reports have suggested that it does not occur in infants (Howell and Knoll, 1941) or is very exceptional (Debbas, 1953 ; Sarrouy, 1950) In Chile, too, it is a rare complication because, as quoted by Aguirre and Rivera (1944), no cases were found by Gutierrez (1904) in 647 cases of amoebic dysentery and none under 10 years of age by Palazicelos and Lerner (1941) in 92 cases of amoebic liver abscess They reported two cases of their own and discussed 133 children with various liver abscesses which they found recorded in the literature Included in these were the 112 cases reported by Legrand in 1906, but very few were in infants De La Maza and Guzman (1953) collected 16 papers which reported only 39 cases of amoebic liver abscess in infancy and they attribute 7 of these to Legrand

Wherever amoebiasis is endemic, it is to be expected that the children and infants should also become infected, and it is believed that amoebic liver abscess in children in such areas is not a rare disease This is certainly true in Durban where amoebiasis is a serious problem among the Bantu (African) population This view strongly supports the excellent article by Torroella *et al* (1956) in which 14 cases under six years of age were reported Here 16 cases are recorded which were cared for in our paediatric ward during the periods 1948 to 1951 and 1954 to 1957 in all covering an 8 year period

Records of 6 other cases seen in 1952 and 1953 were unfortunately destroyed in error It is also possible that a few patients were treated in the general wards This hospital cares for a small proportion only of the African population of Durban and surrounding districts The majority are very poor, ignorant, malnourished and live in unhygienic surroundings As many as 64 cases in children are known to have been admitted to the larger public hospital over a period of six years (Scragg, personal communication)

All our patients were Bantu, 7 female and 9 male with only 4 over 2 years of age , the oldest was 4 years

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* My thank [illegible] medical officers and registrars who helped to care for these cases and to Dr G G [illegible] Medicine, University of Natal, for some of the histological reports I am [illegible] Director Amoebiasis Research Unit, Durban for helpful criticism and advice and for access to the unit's medical literature

CASE REPORTS

The following are four illustrative case reports :

Case 2. V.P., aged 8 months, had abdominal pain with the passage of green, mucoid, blood-stained, semi-formed stools for the previous " few weeks." On examination, the infant was very dehydrated, restless, cold and in pain. The liver was not markedly enlarged. Intravenous therapy was begun immediately. A stool examination revealed blood and mucus but no amoebae ; the haemoglobin was 11.8 g. per cent. and white blood count 15,000 per c.mm.

On the 11th hospital day, a sudden temperature of 105°F. developed and the white blood cell count was 34,000 per cmm. Two weeks later a tender fluctuant swelling was noticed in the left hepatic lobe and 61 ccs. of sterile " anchovy-like " pus was aspirated. Emetine and diodoquin were given. The infant improved but the lump remained, was not tender and a further aspiration only yielded 1 cc. of thick pus. One week later the temperature rose steeply to reach 105° and the right side of the liver was enlarged and tender. Further aspiration did not reveal pus from either lobe the pyrexia settling after the 6th day of a further 10 day course of emetine and diodoquin. He was discharged much improved with an apparently normal liver, 9 weeks after admission.

Case 8. Z.D., a male of 2 years, had passed loose stools with blood and mucus on and off for 2 months despite various treatment. Tenderness to touch in the upper abdomen was then noticed together with some swelling the day before admission (Fig. 1). The child did not look ill despite temperature 104°F. He was a little pale and unco-operative. A lump about 2 in. by 1 in. was palpable in the epigastrium merging with the left lobe of the liver which was enlarged 2 in. from the costal margin and was firm and tender. Aspiration revealed 20 ccs. of greenish yellow pus from which a gram negative bacillus was grown but unfortunately was not identified. Although the pus was more suggestive of a pyogenic abscess, emetine gr. 1/6 daily for 10 days and Aralen 0.125 gm. daily for 15 days, together with penicillin 300,000 units daily was given. The temperature settled within 96 hours. Re-aspiration 7 days after admission produced 25 ccs. of greenish-yellow pus. Three days later 3 roundworms were passed. On discharge 16 days after admission, this child appeared quite well and fully recovered.

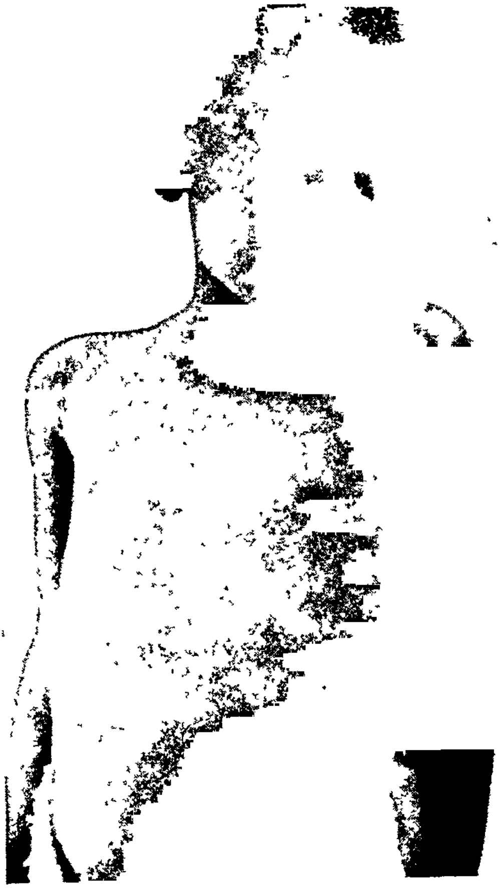

FIG. 1. Amoebic abscess of left lobe of the liver in two year old boy (Case 8).

Case 10. C.M., aged 2½ years, was admitted for vomiting, a cough and loose stools containing blood and mucus, of one week's duration. The child was desperately ill, pale, toxic with fever 102.4°F. He was dyspnoeic and had dullness to percussion at the right lung base with some rhonchi and diminished air entry present. The abdomen was slightly distended and the liver enlarged 3 in. below the costal margin. A stool showed active *E. histolytica*, but he looked too ill to undergo liver aspiration. For the same reason, emetine was withheld and he died within 12 hours of admission.

Post-mortem examination revealed a liver studded with abscesses in both lobes ; they were deep in the liver substance, with one adherent to the pericardium which contained 10 ccs. straw coloured fluid. In some abscesses the pus was canary-yellow, but in others it was typically " anchovy sauce." Numerous amoebae were present on histological examination. The lungs showed consolidation at both bases but the lower bowel was only injected and did not show ulceration.

Case 16. T.M., aged 4 years, was admitted because of the passage of loose, green, bloodstained, mucoid stools for 3 weeks and a painful swelling in the right hypochondrium for 2 days.

He was desperately ill, emaciated and showed evidence of kwashiorkor with typical skin changes and mild oedema of the feet and legs The liver was enlarged 3 in below the costal margin, was tender and revealed a fluctuant lump 3 in in diameter , the overlying skin was not inflamed but did appear a little shiny A stool contained blood and mucus and numerous active forms of *E histolytica* On aspiration of the abscess, 40 ccs of typical blood stained ' anchovy like " pus was obtained During the following week he remained desperately ill , despite his fever settling to normal by the 7th day, vomiting occurred daily with loose bloody stools and anaemia supervened Aspirations were performed every 3rd day Intravenous therapy followed by blood transfusion was necessary on the 11th day and thereafter, he began to improve slowly Aspirations were continued and, in all 9 were carried out each averaging 40 to 100 ccs The last one performed 4 weeks after admission did not reveal any pus By this time he was much improved and when discharged 7 weeks after admission, he was well, happy and gaining weight

DIAGNOSIS

The clinical picture in these infants varies tremendously and, unless one is always actively suspicious of the possiblity of an abscess developing in the liver, cases will continue to be misdiagnosed The infant may appear to be comparatively well or may be desperately ill and bronchopneumonia may be considered because of an anxious expression, active alae nasi, dyspnoea and a cough On the other hand, loose stools containing blood and mucus may suggest acute bacillary dysentery In some cases, all these symptoms may be present and admission requested for bronchopneumonia with enteritis The abdomen is often so distended that the liver cannot be palpated or tenderness elicited

The principal clinical features are summarised in Table I There was usually a history of diarrhoea, often of long standing, of 2 to 5 stools per day containing mucus and blood This occurred in 13 cases A long history is to be expected because the disease does not usually begin as an acute fulminating dysentery and the parents do not seek medical aid readily Fever was usually present and averaged about 102°F The white cell count was raised in 8 cases out of 11 in which it was recorded and ranged between 12,000 and 29,900 per cmm

The stools contained *E histolytica* in 6 of 13 patients examined, but unfortunately specialised laboratory facilities were not available and these observations were therefore made infrequently by the clinical staff

The diagnosis is fairly straightforward when a swelling is obvious to the naked eye and, on palpation, is part of an enlarged liver , it will then protrude anteriorly from either lobe, present in the epigastrium or even swell out in the flank. When fluctuant, as it may well be, it does not appear to be as tender to pressure as when the liver is firm, hard and markedly enlarged , then it is often exquisitely tender In this series a localised swelling 2 to 4 inches in diameter was observed in 10 cases, 5 in the right and 5 in the left lobe of the liver

The cases can be divided into 2 groups—those diagnosed early and those late In the first group, 6 were diagnosed within 48 hours of admission by finding pus on aspiration, but, in 7 cases, diagnosis was made only between the 6th and 26th day after admission Two cases died within a few hours of admission before aspiration could be carried out

The criteria for the diagnosis of amoebic liver abscess in these cases may well be criticised when one is conscious of the possiblity of pyogenic liver abscess and those caused by *Ascaris lumbricoides* (DE SILVA, 1950 , STRANSKY and DAUIS-LAWAS, 1948) In all the cases except 2, blood and mucus were present in the stools In most cases the pus was the ' anchovy sauce ' usually found in amoebic abscesses Those patients falling into the ' late group ' had been given either penicillin or aureomycin before a diagnosis

TABLE 1. Summary of sixteen cases of a

On Admission							Type of Stool	Lump in lobe of liver	Severity of illness	W.B.C	Temp.	*E. histolytica in* stools	Discharge wt. *in* lbs.	Basis diagn
Date	Case No.	Name	Age in years	Sex	Adm. wt. in lbs.	Diagnosis								
24.6.48	1	S.S.	18/12	M	16½	Gast.-Ent.	M	Left	Mod.	—	101°	—	16½	Anchovy p
2.7.48	2	V.M.	8/12	M	18	Gast.-Ent.	B & M	Left	Sev.	15,000	99.6°	—	16½	61 cc. gr blood
18.2.50	3	K.H.	16/12	F	18	Am. Dys. & B.P.	B & M	Right	Sev.	29,900	103.5°	+	22	60 cc. yell
27.2.50	4	N.H.	20/12	F	15½	Am. Dys.	B & M	Right	Sev.	13,000	103.8°	+	18	90 cc. anch
19.3.50	5	P.M.	18/12	F	23½	B.P. & Am. Dys.	B & M	Nil	Mod.	9.600	100.6°	—		240, 135 & *anchovy pu*
14.9.51	6	T.D.	10/12	F	—	Gast.-Ent.	B & M	Nil	Mod.	17,600		+		60 cc. anoc
6.1.54	7	T.N.	2	M	24½	Am. L. Ab.	M	Right	Mild	18,800	101.6°	—	23½	10 cc. anch
20.1.55	8	Z.D.	2	M	21½	Am. L. Ab.	B & M	Left	Mild	22,600	104°	—	22½	20 cc. gree
16.2.55	9	N.N.	3½	F	27½	Am. L. Ab.	Normal	Left	Mild	10,000	98.8°	Not exam.	26	12 cc. anch
11.4.56	10	C.M.	2½	M	19	Am. Dys. ? Ab.	History of diarrhoea	Nil	Sev.		102.4°	Not exam.		Autopsy
14.5.56	11	V.B.	17/12	M	21½	Am. L. Ab.	B & M	Left	Mild		100°	—		*10 cc. anch*
18.6.56	12	T.D.	16/12	M	—	B.P.	History of diarrhoea	Nil	Sev.		102°	Not exam.		Autopsy
14.11.56	13	Z.S.	7/12	F	17½	?Am. Hepatitis	Normal	Nil	Sev.	10,600	100.4°	—		Autopsy
10.3.57	14	B.N.	21/12	F	17	Am. Dys.	B & M	Nil	Mild	12,000	100°	+	18	Anchovy p 90, 15 cc
20.5.57	15	D.M.	3	M	24½	Gast.-Ent.	B & M	Right	Mod.	15,000	103.2°	+	24½	30 cc. yell
30.12.57	16	T.M.	4	M	25	Am. L. Ab.	B & M	Right	Sev.		101°	+	26½	Anchovy p cc.

Gast.-Ent. = Gastro-Enteritis ;
Am. Dys. = *Amoebic Dysentery* ;
B.P. = Broncho-Pneumonia ;
Am. L. Ab. = Amoebic Liver Abscess ;

B & M = Blood and Mucus ;
H. of D. = *History of Diarrhoea* ;
Di. = Diodoquin.

of amoebic liver abscess was made. They only improved after the introduction of emetine and chloroquine. Case 5 died from a complicating right basal pneumonia and pleurisy, the liver abscess having almost healed. Case 13 died soon after admission but unfortunately no histological sections of the liver were taken and the abscesses may have been due to secondary pyaemia, although no primary septic focus was found.

Culture of pus specimens were sterile in 2 cases, grew *E.coli* in two, *Staphylococcus pyogenes* in another and an unidentified gram negative bacillus in another. In case 10, the abscesses in both lobes contained amoebae.

TREATMENT

This is shown in Table I. All cases were given emetine which remains the first drug of choice. Diiodohydroxyquinoline ("Diodoquin " or "Embequin") was added originally after a week's therapy and, when chloroquine diphosphate became available, this was used after the course of emetine. Many children also received sulphonamides and penicillin for the treatment of complications or before the specific diagnosis had been made.

At present it is our policy to give all these drugs immediately the diagnosis is made. Drug toxicity in children has not been marked ; vomiting when it occurred could usually be attributed to the disease or some complication and at no time was it necessary to discontinue specific therapy. The routine in use at present is : emetine 5 mg. per lb. body cess in young African children.

Pus culture	Further observations	I V.	Days asp performed	Em	Chlor	Di	Other antib	Result	Days in hosp
—	Measles 31 8 48		13	Em		Di	Sulf	Cured	85
Sterile	2 courses treatment	I V.	26, 36, 50	Em x 2		Di x 2	Pen	Cured	63
—	Gained 4 lbs		16, 17, 22, 24	Em	Chlor	Di		Imp	61
—	R diaphragm raised on X-ray	I V	10, 20	Em	Chlor	Di	Sulf Pen	Imp	53
Sterile	Sudden unexpected death		2, 5, 10, 13	Em	Chlor	Di	Sulf Pen	Died	15
—	8 aspirations 33 days	I V	x 8	Em	Chlor		Sulf Pen	Imp	41
—	—		2, 7, 17	Em	Chlor			Imp	19
Gm Neg Bac	Sig Neg Ascaris present in stool		1, 7	Em	Chlor		Pen	Cured	16
Staph pyogenes	Sig Neg Ascaris present in stool		2, 7	Em	Chlor	Di		Cured	16
—	Abscesses both lobes containing amoebae							Died	Under 24 hrs
—	—		1, 7, 14	Em	Chlor	Di		Imp	18
—	Pus in R chest 3 abscesses in liver							Died	Under 24 hrs
—	Pus in peritoneum							Died	Under 24 hrs
B coli	Ascaris pres in stool Sig Neg		12, 15, 17	Em	Chlor	Di	Aur *Pen*	Imp	31
—	Ascaris present in stool		16, 22	Em	Chlor	Di	Aur	Imp	35
B coli	Ascaris present in stool	I V.	1, 4, 7, 9, 15, 21, 23, 28, 34	Em	Chlor	Di	Pen	Cured	47

Sulf = Sulphonamide ,
Pen = Penicillin ;
Aur = Aureomycin ,
Sig = Sigmoidoscopy .

Em = Emetine ,
Chlor = Chloroquine ,
Imp = Improved ;
I V = Intravenous Therapy

weight total dosage divided into 10 daily injections Chloroquine diphosphate 7 mg. of the base per lb. body weight daily for 15 days. Diiodohydroxyquinoline 40 mg. per lb. body weight daily for 20 days ; tetracycline is given when dysentery is present Supportive therapy with intravenous fluids and blood transfusion is necessary on occasions Aspiration is always carried out and repeated every few days until all the pus has been evacuated. This, of course, depends upon the size of the abscess and in most cases only two or three apirations are necessary. However, in case 6, eight aspirations were performed and in case 16 the nine aspirations produced a total of 480 cc. of pus.

DISCUSSION

Proof of diagnosis in a case of amoebic liver abscess is not easily obtained. To find amoebae in aspirated pus is most difficult and usually unsuccessful. The same applies to the stools if the acute dysenteric phase is already over. In the event of a clinical diagnosis being made and a response to therapy with emetine obtained, it seems fair to assume the diagnosis especially if substantiated by ' anchovy-sauce ' pus on aspiration. Culture of this pus is often sterile but when an organism is grown we have believed it to be a secondary invader or contaminant. Many other workers believe this too.

Case 8 could be considered to have a pyogenic abscess because he was given penicillin as well as emetine and chloroquine, did not have amoebae in the stools and produced green pus containing an unidentified gram negative bacillus. Sigmoidoscopy was also normal. Ascaris ova were found in the stools and it could be suggested that the abscess was due to ascariasis. Because the clinical picture, the ' pointing ' of the abscess (Fig. 1) and the response to therapy was so similar to the other cases it suggested that this was due to *E.histolytica.*

Case 9 had ' anchovy-sauce ' pus from which *Staphylococcos pyogenes* was cultured, but she was given anti-amoebic therapy only, with a good response. Case 12 may have had a pyogenic abscess, as no proof or suggestion of amoebiasis was obtained, except a history of previous diarrhoea. He is included in the series because it is fairly common for amoebic liver abscess to rupture into the thorax. Contamination of aspirated pus or secondary invasion of an amoebic liver abscess probably occurs quite frequently. Case 14 illustrates this well because active amoebae were found in the stools, ' anchovy ' pus was aspirated from the liver but *E.coli* was also cultured. Abscess of the liver due to ascariasis is very rare, but it is possible that in this case roundworms initiated the abscess in a child with amoebic dysentery. On clinical grounds, however, the diagnosis of an amoebic liver abscess cannot be questioned.

Five patients had fairly heavy loads of ascaris ova in the stools and it is interesting to note that in four (cases 8, 9, 14 and 16) an organism was cultured from the pus. Three of these had typical ' anchovy ' pus. This leaves cases 8 and 15 as possible cases of ascariasis of the liver, but case 15 had amoebic dysentery and one would hesitate to diagnose both diseases in the same patient.

The prognosis is excellent in those cases which present with a visible lump in the liver because attention is drawn to it, aspiration is carried out immediately and specific therapy instituted. Open surgical drainage has always been rigidly eschewed in the past for fear of secondary infection. With the introduction of broadspectrum antibiotics, this may now be invalid and a more rapid cure obtained in those cases with a fluctuant abscess pointing through the abdominal wall ; this may obviate the necessity of repeated aspirations as in case 16. In this series, however, open drainage has not been performed.

On the other hand, those cases in which the liver is enlarged and somewhat tender are more difficult to diagnose ; they are ill and one hesitates to aspirate without due cause, thus delaying therapy. Of the 4 deaths, three occurred within 24 hours of admission and were probably beyond redemption. Of these, 2 had perforated, one into the chest, and the other into the peritoneal cavity. In 2 children (Cases 10 and 14), abscesses were present in both lobes at autopsy.

Treatment over so many years has of necessity varied, but, despite this, the results have been good, giving a mortality rate of 7.7 per cent, if deaths with 24 hours are excluded. It may be better to commence therapy with emetine and an antibiotic, and follow this after 10 days with chloroquine and diiodohydroxyquinoline, thus treating the patient actively over a longer period. For acute amoebic dysentery, WILMOT (1951) showed that oxytetracycline (" Terramycin ") or chlortetracycline (" Aureomycin ") were most effective and this was confirmed by ARMSTRONG *et al* (1952) and ELSDON-DREW *et al* (1952). WILMOT (personal communication) believes that emetine and chloroquine are probably equally effective, but that relapses are more likely to occur after a single course of chloroquine.

This series is far too small and the courses of treatment too varied for the drawing of any valid conclusions, but it does suggest that a cure will be effected, provided adequate specific therapy, repeated aspirations of the liver abscess and supportive treatment is given.

SUMMARY

Sixteen cases of amoebic liver abscess in infants and young children are reported together with their case histories Because definitive diagnosis by the demonstration of *E histolytica* is very difficult, a clinical diagnosis must be made and confirmation obtained by the aspiration of pus and a satisfactory response to emetine therapy The group of liver abscesses that point anteriorly through the abdominal wall respond very well to therapy , those which point up through the diaphragm or down into the abdominal cavity are the most difficult to diagnose because the symptoms and signs are often obscure Delay in diagnosis may allow the abscess to perforate and thus cause death Four cases (25 per cent) died 3 within 24 hours of admission

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BACKGROUNDS AND FOLLOW-UP OF CHILDREN WITH KWASHIORKOR

by

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Very little is known about the progress of children before and after their attendance at hospitals with kwashiorkor. VEGHELYI (1950) in Budapest reported a high mortality and poor recovery among children followed three and a half years after kwashiorkor. This gloomy picture was probably brought about by the unusually severe conditions of siege and deprivation under which these children had been living. Other observers have formed the impression that under normal tropical conditions the ultimate prognosis is good provided adequate treatment is given in the acute stage, and the subsequent progress of such children is not necessarily poorer than that of other children living under the same conditions. SUCKLING and CAMPBELL (1957) reported a five-year follow-up of 27 coloured children in Cape Town in which they cited poverty as a most important background factor, remarked on a low recurrence rate in spite of returning to the poor home background, and gave an excellent prognosis for full recovery. Follow-up studies have also been done in South India (RAMANATHAN et al., 1955 and SRIKANTIA et al., 1958) which indicated that children observed from 9 months to eight years after kwashiorkor continued to recover after discharge from hospitals and suffered from no permanent sequelae.

The most important and puzzling feature, which is emphasized in all the sources quoted above, is that although the child returns after treatment for kwashiorkor to exactly the same conditions of poverty and malnutrition from which he came, he nearly always makes good progress and seldom relapses.

CHILDREN STUDIED

The children studied were children of various African tribes who attended child welfare clinics in the vicinity of Kampala, Uganda. Some attended regularly every few weeks, some less regularly. Some came from distant parts of East Africa and Ruanda-Urundi and were often lost to us for long periods while they visited their home villages. When a child stopped coming to the clinic, it was usually impossible to trace the family. Under such conditions any follow-up study is necessarily patchy and incomplete.

The onset of kwashiorkor was observed in some children attending the child welfare clinics fairly regularly. Most of the children (WELBOURN, 1955) showed a falling-off of growth during the weaning period and it was not always easy to pick out which of the children who were growing poorly — and who also often lost much of their liveliness and had light hair — were likely to develop kwashiorkor. Skim milk powder was on sale at cost price at the clinics but no protein-rich supplement was available for free distribution as a prophylactic measure. Thus, apart from the occasional purchase of a packet of skim milk powder, a child's condition was allowed to run its course until the appearance of indisputable signs of kwashiorkor.

Antimalarial drugs were not used prophylactically. All pyrexial illnesses were treated with chloroquine without waiting for a report on the blood-film. Ascaris infestations were encountered fairly frequently ; usually they appeared to have little effect on the child's general health, but if symptoms were present piperazine was given.

Kwashiorkor group The clinic record cards of children who developed kwashiorkor between 1952 and 1957 were picked out for special study Since the basic picture of kwashiorkor varies slightly in different parts of the world (TROWELL, DAVIS and DEAN, 1954), it is necessary to define the manifestations in the present series

The ages of the children were as follows —

Under one year	1
One to two years	40
Two to three years	23
Four years	1

Many of the children were less severely ill than would be the case in children observed in a hospital The general picture is summarized in Table I

TABLE I Clinical picture of kwashiorkor among sixty five children attending child welfare clinics

Number in whom disturbance of growth, oedema, hair changes and misery were all present	45
Recent history of swelling but pitting oedema absent at time of examination	10
Hair changes absent	9
Misery absent	2
Severely ill, referred to hospital (of these dermatosis present in 6)	22
Less severely ill, treated at clinic	43

The principal manifestations of kwashiorkor—disturbance of growth, oedema, hair changes and misery — were all present in 45 of the 65 children seen Disturbance of growth was marked in all 65 children, but in 21 one of the other manifestations was absent All cases were thought to have been oedematous at some time, but in 10 of them no pitting oedema was found at the time of examination in the clinic All severely ill children (22) were referred to hospital for in-patient treatment The less severely ill (43), were treated at the clinic with a small supply of free skim milk powder supplied by the Uganda Branch of the British Red Cross Society, or with whatever samples of other protein rich foods happened to be available

Fourteen children were observed from before the onset of growth disturbance until the age of four years or more , ten others were observed for from one to three years

Control group For purposes of comparing the social and family circumstances of the kwashiorkor children with those of normal children of the same age, record cards were used of all children born in 1954 or 1955 who attended a child welfare clinic in 1957 Only one child in each family was counted, and for families with more than one 1954-1955 child, the one with the most complete record was used Only one child in each pair of twins was counted No families in the kwashiorkor group were included in the control group

Growth standard For purposes of comparing growth records of kwashiorkor children with normal children of the same ages, heights and weights were used of Ganda children measured at child welfare clinics and nursery schools between 1951-1957 The methods whereby these measurements were compiled have been recorded (WELBOURN, 1955)

Tribal differences The population living in the neighbourhood of Kampala is drawn from many parts of East Africa Among the children studied the most important tribes were as follows *Ganda* Indigenous inhabitants of the Province of which Kampala is the centre *Ruanda* Immigrants from Ruanda-Urundi, working either as unskilled labourers or as small cultivators. *Luo :* Immigrants from Kenya, mainly living in the town working either as domestic servants or as skilled or semi-skilled labourers. Differences between the background histories of children with kwashiorkor from these different groups will be commented upon.

FINDINGS

Family circumstances. The family circumstances of the kwashiorkor children compared with those of the control children in different tribal groups are shown in Table II.

TABLE II. Family circumstances of kwashiorkor children compared with those of control children in different tribal groups.

	Ganda		Ruanda		Luo	
	Kwashiorkor	Control	Kwashiorkor	Control	Kwashiorkor	Control
Number of boys	*13*	*143*	*17*	*65*	*10*	*64*
Number of girls	11	105	10	71	3	59
Total number of children	24	248	27	136	13	123
Number of families	22	248	26	136	11	123
Average size of family	3.0	3.1	3.5	2.9	2.3	3.5
Family mortality (1)	18%	12%	42%	32%	24%	22%
Slightly educated families (2)	2	119	0	2	0	4
Highly educated (3)	0	18	0	0	0	0
Living in town	1	82	3	18	11	120

(1) Family mortality : each mother was asked the number of children she had borne and how many had died. The family mortality is the number of children who had died expressed as a percentage of the total number of children born.

(2) Slightly educated families: families in which father worked as a clerk or in some skilled occupation and mother had done at least three years in primary school.

(3) Families of college graduates or senior secondary school teachers.

There were more boys than girls among both kwashiorkor and control children, but this sex difference was slightly more marked among the kwashiorkor children. There was no difference between the average size of family or family mortality in the different groups. Among the Ruanda and Luo practically none of the families were educated, but among the Ganda there was a difference between the kwashiorkor and control children : of the Ganda kwashiorkor children only two of the twenty-four came from slightly educated families, whereas among the Ganda control children 48 per cent. came from slightly educated families and another 7 per cent. from highly educated families.

Slightly fewer kwashiorkor children than controls lived in the town. This difference was significant among the Ganda, but not among the other tribal groups of whom the Luo were living mainly in the town and the Ruanda mainly in the country.

Family stability. Factors related to the stability of the child's home background are shown in Table III.

TABLE III *Factors related to the stability of the home background of kwashiorkor children compared with that of control children in different tribal groups*

	Ganda		Ruanda and Luo	
	Kwashiorkor	Control	Kwashiorkor	Control
Total number of children	24	248	41	259
Living away from home	11 (46%)	23 (9%)	1	2
Parents separated	3 (12%)	30 (12%)	6 (15%)	5 (2%)
Father dead	0	4	0	3
Mother dead	1	3	2	0
Polygamous families	0	18	0	9

They varied between the different tribal groups Among the Ganda it was common for children to be sent away from home, very often at or soon after completion of weaning Nearly half the Ganda kwashiorkor children had been abruptly separated from their mother's in this way, whereas only one-tenth of the Ganda control children had been so separated This kind of sudden separation was seldom practised by the other tribal groups Among the Ganda, the parents of 12 per cent of the children were not living together but there was no difference between the kwashiorkor and control groups in this respect Among the Luo and Ruanda there was a difference between the two groups 15 per cent of parents were separated in the kwashiorkor group, but only 2 per cent in the control group Polygamous homes, those with more than one wife permanently in residence, were often relatively stable , no child with kwashiorkor in this series came from such a home

Lactation and family spacing Factors related to the mother's lactation history and family spacing are shown in Table IV The lactation history was available for 51 kwashiorkor children and for 226 in the control group The history was assessed in most cases by observation of the child's progress at the clinic, but a few histories not based on clinic observation were included where a mother was able to give a clear account of the child's progress

Failure of lactation was considered from the point of view of inadequacy during the first six months of life and from that of early weaning (weaning before one year) There were marked differences in this respect between the Ganda and the other tribal groups Both underfeeding during the first six months and early weaning were far more frequent among the Ganda than among the Ruanda and Luo Among the Ruanda and Luo, weaning before twelve months seldom occurred unless the mother was pregnant, and even where the output of breast-milk was insufficient before six months, Luo and Ruanda babies often continued to suck at the breast for a year or more

Table IV shows that there were marked differences in the lactation histories of the kwashiorkor children compared with the control group , underfeeding at the breast during the first six months occurred in over 50 per cent of the kwashiorkor children in both tribal groups, but in only 13 per cent of the Ganda control children, and only 3 per cent of the Ruanda and Luo control children Weaning before twelve months occurred in 40 per cent of Ganda children and 15 per cent of Luo and Ruanda children in the

TABLE IV. Lactation histories of kwashiorkor and control children in different tribal groups.

	Ganda		Ruanda and Luo	
	Kwashiorkor	Control	Kwashiorkor	Control
Number from whom lactation history available	22	188	29	138
Successful lactation for one year or more	2 (9%)	98 (52%)	4 (14%)	114 (83%)
Inadequate lactation during first 6 months	14 (64%)	24 (13%)	15 (52%)	4 (3%)
Total weaning before 12 months	16 (73%)	77 (41%)	10 (35%)	21 (15%)
Weaning before 12 months due to pregnancy	3	16	10	6

control groups, but occurred approximately twice as frequently in the kwashiorkor children. Among the Ganda the commonest cause of early weaning was failure of lactation subsequent to artificial feeding. Among the Ruanda, pregnancy was the commonest cause of early weaning, and this was particularly so among the kwashiorkor children.

Follow-ups

Disturbance of growth. Fig. 1 shows a typical weight and height chart of a child followed from birth through severe kwashiorkor until the age of five years. His progress in weight and height is compared with standard curves for Ganda children of the same ages. It can be seen that the onset of kwashiorkor was preceded and followed by a period of disturbed growth which lasted, in this case, nearly three years. The period of disturbed growth was divided into three stages as follows :—

Stage 1. (Prodromal) Loss of vitality, hair losing colour and crispness. Falling-off of growth in height and weight.

Stage 2. (Illness) Oedema, misery and other signs of acute illness. No growth. Weight changes dependent on presence of oedema.

Stage 3. (Recovery) Return of vitality, hair becoming dark. Accelerated growth in height and weight until growth became stabilized on an even track.

In this child, whose father was a labourer from Ruanda, the onset of Stage 1 was preceded by a period of growth which, in spite of the occurrence of various infections and of relatively early weaning, did not differ from the standard for Ganda children of the same ages. From 21 months there was a marked falling-off in weight-increase, corresponding to the onset of Stage 1, which continued for three months. The onset of Stage 2 was marked by the sudden onset of oedema and after a few days by peevishness and misery replacing the child's usual happy demeanour. In this child, Stage 2 was complicated by the occurrence of a relapse ; this was unusual and will be further discussed later. Since this child's family were living on a coffee estate where there was a nurse to supervise therapy, an attempt was made to treat him at home. The mother was told to make porridge and soup from the maize meal and beans which formed part of her husband's rations and was given 8 ounces of skim milk powder weekly to mix with the child's food After a month of this treatment, the child's condition was much improved, his oedema had gone and, although he was quieter than usual and seemed to tire easily, he was no longer miserable Unfortunately a month later he became ill with a spasmodic cough and vomiting , the oedema returned and increased in severity The mother was strongly advised to take the child to hospital, but instead she stopped coming to the clinic When the child was next seen, three months later, he was severely ill with much oedema He was admitted to the Medical Research Council's ward at Mulago Hospital where he remained for one month

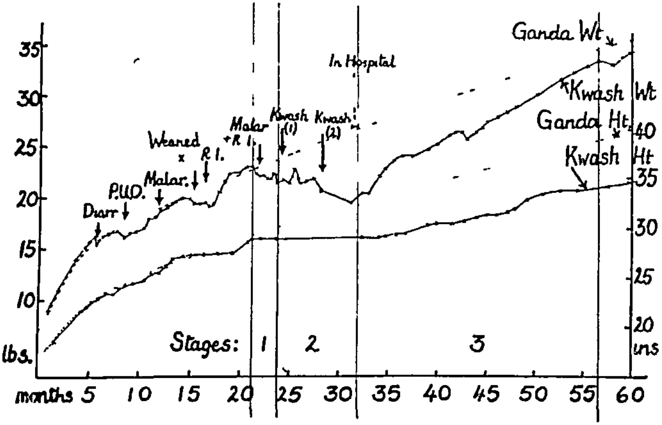

FIG 1 Typical weight and height chart of a child followed from birth through severe kwashiorkor up to the age of five years

On return from hospital, his acute symptoms had disappeared and he had begun to gain weight He had entered Stage 3, which in this child was prolonged , two years passed before his growth in weight returned to within one pound of the standard weight for age and his height was still, after 30 months nearly five inches (11 per cent) below the standard for this age His hair began to grow black within two months of his discharge from hospital , he was cheerful and friendly and gaining weight fast, but for about a year he was lacking in vitality and slightly anaemic At five years old, he seemed to be a normal, healthy little boy Although he was still below the average height for his age, he looked sturdy, his hair was black and crisp, and he was lively and cheerful

Figure 1 shows a pattern which was typical for all the children although the duration of the stages varied from child to child The duration of the Stages for different children is shown in Table V

This table shows that for most children the duration of Stage 1 was from three to twelve months Stage 2, the acute illness, usually lasted less than one month, although in a few who could not be treated promptly, it dragged on for up to three months The only children whose acute symptoms continued for over three months were the four children who had relapses In three of these children the relapses followed inadequate treatment ,

TABLE V. Duration of growth disturbance in children with kwashiorkor.

	0-1 month	1-3 months	3-6 months	6-12 months	12-24 months	24-36 months	Indefinite	Total observed
Duration of Stage 1		2	5	11	2			20
Duration of Stage 2	12	4	2	2				20
Duration of Stage 3				2	11	1	2	16

Note. The four children indicated in whom Stage 2 lasted for over three months were those in whom relapses occurred after a period of remission.

only one child relapsed after really adequate hospital treatment. In stage 3, the majority of children had settled to steady rates of growth before two years had passed. In two children the acceleration of growth in Stage 3 was not so well-marked and the transition to a steady rate of growth was indefinite.

The final level at which growth in height and weight became stabilized was related to the child's stature before the illness. Of the 14 children who were followed from infancy until after recovery, seven were close to the standard in weight (within one pound) and height (within one inch) before the onset of Stage 1.

Of these, five returned to the standard at the end of Stage 3 and two returned to the standard in weight but lagged behind in height. The other seven were well below the standard in weight and height before the onset of Stage 1. Of these, six returned to the same level below and parallel to the standard at the end of Stage 3 and one returned to the same level in weight but to a lower level in height.

Factors precipitating kwashiorkor. In the preceding section, a disturbance of growth was described which often occurred in children who were already under the standard weight and height and who appeared to suffer from chronic underfeeding. An attempt was next made to study the traumatic factors which might precipitate deterioration in a child's condition at the onset of the first stage of growth disturbance, or which might precipitate relapses or delay convalecence. The factors were not easy to define because the majority of the children studied suffered recurrent infections and traumata. The factors which were thought to be important in the present study are listed in Table VI.

TABLE VI. Factors precipitating kwashiorkor or causing relapse.

	Precipitating Stage 1	Causing relapse
Total weaning	14	—
Weaning—sudden separation from mother	5	—
Weaning—mother pregnant	4	—
Separation from mother not associated with weaning	3	—
Malaria	6	—
Spasmodic cough and vomiting	4	2
Other respiratory infections	1	1
Gastrointestinal infections	3	—
Tuberculosis	1	
Ascariasis	2	
Skin sepsis	1	
Urinary infection	1	

Separation from the mother either at the time of weaning or later on was marked by deterioration in eight children Even when not followed by separation from the mother, weaning was often followed by deterioration in the child's condition, and this was particularly so when weaning was hastened because of the mother's pregnancy In all the children studied kwashiorkor occurred before the birth of the next baby but in two children convalescence was delayed by deterioration apparently due to jealousy

Infection played a part which was not easy to define Malaria very frequently caused deterioration The most dangerous infection was a spasmodic cough and vomiting, similar to whooping cough but less prolonged and often followed by a second attack several months or years later

This type of infection precipitated deterioration in Stage 1 in four children and precipitated two of the four relapses Other respiratory infections (in one child accompanied by chronic otitis media) caused deterioration at the onset in one child and precipitated another of the relapses Measles, although a common feature in the histories of children admitted to Kampala hospitals with kwashiorkor, did not occur in any of the children in the present series Pulmonary tuberculosis was found during the acute stage in one child, and in two others (one with a pulmonary lesions, one with cervical adenitis) delayed convalescence All three children with tuberculosis responded well to antibiotic treatment and made a good recovery The part played by ascariasis was difficult to assess because the majority of the Ruanda children studied, including many who were apparently well carried more or less heavy loads of the worms In two children a heavy infestation was thought to contribute to their deterioration A severe scalp infection with a cervical abscess caused deterioration at the onset in one child One child was found to have a urinary infection when she was admitted to hospital with kwashiorkor

DISCUSSION

Background Kwashiorkor was slightly commoner among boys than girls , this is in keeping with findings elsewhere (TROWELL, DAVIES and DEAN, 1954 , SUCKLING, 1957) It was not possible to demonstrate any difference in size of family or family mortality between families of kwashiorkor children and controls , but information of this kind is very difficult to be certain about among people who may dislike being asked to enumerate their living and dead children GONGORA (1957) found that child mortality was higher for siblings of children attending Uganda dispensaries with signs of malnutrition than for siblings of children attending dispensaries with non-nutritional disorders

In other parts of the world kwashiorkor is particularly related to poverty (SUCKLING 1957) In the present study no such relationship could be demonstrated The homes of practically all the kwashiorkor children were visited and none of the families seemed obviously poorer than their neighbours , many were comparatively well-to-do with big plots of land where they grew cash crops such as cotton and coffee or kept cows and sold the milk In terms of cash income, the families in the Ruanda groups were the poorest, but all the families studied had land available for cultivation of food, and those who were working as labourers also had maize flour and beans issued to them The really difficult conditions occurred among town-dwellers, but among the Luo group (all of whom were living in the town) there was no excessive incidence of kwashiorkor, and among the Ganda, there were fewer town-dwellers among the kwashiorkor children than among the controls DEAN (1958) also found that kwashiorkor occurred less frequently among town-dwellers It seemed that town-dwellers were more likely to set aside cash for the purchase of special foods for children such as bread, milk and fruit. Among the Ganda, ignorance was often far more important than poverty. Very few children with kwashiorkor came from even slightly educated homes, although slightly educated families were not necessarily better off financially than peasant families who cultivated food and cash crops.

Lack of family stability seemed to play an important part in predisposing a child to kwashiorkor. Among the Luo and Ruanda tribal groups, families tended to be stable and children were seldom sent away from home. When the marriage broke up, the mother was left in foreign territory in unusual conditions of poverty and insecurity ; several children of mothers so situated were found with kwashiorkor. Among the Ganda, marriages often broke up but the effects were less catastrophic because the mother usually had the support of her own family. Among the Ganda, many children succumbed to kwashiorkor when they were living away from home ; these were often children who had been abruptly separated from their mothers at, or soon after, weaning and sent to grandparents or other relations, who often did not give them their proper share of food or attention.

The importance of this practice of maternal separation a as factor in the development of kwashiorkor has been commented upon by GEBER and DEAN (1957). It was of interest that polygamous homes, while they were seldom ideally happy or hygienic, at least seemed to provide a more stable environment for a child than could be provided by a mother left on her own.

Many of the children with kwashiorkor had failed to thrive from a very early age ; more than half of them had been under fed at the breast during the first six months of life. It seemed that this early underfeeding predisposed to kwashiorkor later in the weaning period. This has already been commented upon in a previous communication (WELBOURN, 1958), as has the poor prognosis for twins. In the present series, there were more twins among the kwashiorkor children than among the controls ; there were 5 pairs of twins among the 65 kwashiorkor children (8 per cent.) and 10 pairs of twins among the 507 control children (2 per cent). Apart from four twin children in the control group, all these twin children were underfed at the breast from early infancy and all presented serious feeding problems during the weaning period.

Onset. The onset of kwashiorkor was thus the culmination of a series of events which started with untoward predisposing conditions in the child's background and was precipitated by traumatic experiences encountered during the weaning period. Kwashiorkor was regarded as an acute event which was preceded by a first stage in which there was progressive deterioration and failure of growth in height and weight. This first stage was easily definable in retrospect, but difficult to recognize at the time. Many children, particularly after weaning, underwent similar periods of disturbed growth which did not culminate in kwashiorkor. Some of these were not malnourished and the disturbance in growth appeared to be precipitated by a psychological upset. Most of them, however, presented various symptoms (paling hair, loss of liveliness, " puffiness " or slight oedema) suggestive of kwashiorkor, but any definition of a " pre-kwashiorkor " state was very indefinite.

That kwashiorkor occurs as an acute episode following a period of prolonged failure of growth has been illustrated by DEAN (1956) by reference to bone growth. The development of the bones of the hands of children who had been admitted to hospital with kwashiorkor was compared with that of healthy children of the same ages. It was found that, although growth probably ceased during the acute stage, the degree of retardation often found was so great that slowing or cessation of bony growth must have occurred many months previously It was of interest that two children in the present series, one of whom was the child whose chart is shown in Figure 1, were included in DEAN's radiological studies In both these children, the estimated bone age on admission to hospital corresponded to the age at which falling off in growth in height and weight was observed at the clinic

Deterioration during the first stage was often precipitated by traumatic factors of which the most important were infections and psychological upsets, particularly at weaning Of infections, those of the respiratory tract, accompanied by vomiting ranked first, but malaria and gastro-intestinal infections were also important Weaning was particularly traumatic among the Ganda because, even when not followed by separation from the mother , it was regarded as a point of promotion towards adulthood After weaning the child was expected to have less intimate contact with his mother and to start learning good behaviour This could be a period of great strain for both mother and child Among the other tribes, the child was weaned at a later age and was seldom separated from his mother If the child had to be weaned early because his mother was pregnant he often suffered severely not only from dietary depletion, but from psychological disturbances because his mother was tired and anxious Very often the mother was anxious because she feared that the older child might have taken milk which was poisoned by the evil influence of the unborn child It was commonly recognized among all three tribal groups that kwashiorkor (there were words for it in their own languages) was likely to occur if a mother conceived while she was still breast feeding It was not recognized that this had any connection with infant feeding, maternal separation, or even with jealousy, which was such a common cause of unhappiness later on Jealousy, while it was a common cause of unhappiness and ill health, did not become a problem until several months later and was thus more likely to complicate convalescence than to precipitate deterioration during the first stage

The part played by these traumatic factors was by no means well-defined All the children studied had infections of various kinds, many were upset by weaning or separation from the mother, most of them appeared to be having approximately the same kind of diet , yet very few of them developed kwashiorkor The child whose chart is shown in Fig 1 underwent recurrent infections and weaning without apparent ill effects The first stage of growth disturbance did not begin until a year after weaning when he appeared to be making good progress and it was precipitated by malaria and a respiratory infection — illnesses no more severe than many he had weathered previously It seemed that kwashiorkor marked the culmination of the effects and a series of adverse factors occurring at a critical stage in his development

Recovery and follow-up The disappearance of the acute symptoms of kwashiorkor marked the entry into the third stage of growth disturbance during which recovery took place After an acute infection in a normal child, there is a period of accelerated growth, with a rapid return to the previous levels of weight and height (WELBOURN, 1955b) Recovery from kwashiorkor was far more gradual , in most cases from one to two years passed before the child settled to a steady rate of increase in height and weight The ultimate stature of the child was related to the level reached before the onset of growth disturbance Those who were finally below the standard weight and height for normal Ganda children had all except two been similarly below the standard before the onset of growth disturbance SUCKLING (1957) in a five-year follow-up found that children who

PROTEIN-CALORIE MALNUTRITION IN EARLY CHILDHOOD*

(PRACTICAL NOTES)

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Growth in young African children

Growth is the main characteristic of childhood, and many African children of poorer groups, living under both village and town conditions, show the following quite abnormal growth, as judged by weight gain, in the early years of life :

(1) *First six months of life :* excellent growth with sufficient protein and calories supplied by a good flow of uncontaminated breast milk, while the child is protected from many infections by antibodies obtained from the mother during pregnancy ;

(2) *Second six months of life :* fair growth, but breast milk no longer sufficient for child's needs of both protein and calories, and added foods (if any) usually mainly starchy carbohydrates, with little protein ;

(3) *Second and third years of life :* poor growth, or even no growth, or loss of weight for long periods, due to the low protein, mainly carbohydrate diet (starchy foods, sometimes small quantities of breast milk, a little added animal protein, such as cow's milk, meat or fish) and to the numerous infections that occur (including diarrhoea, malaria, chest infection). During this stage, protein-calorie malnutrition may occur. The two most common clinical forms are kwashiorkor and nutritional marasmus.

Average weights of healthy Baganda children of both sexes, collected by the Infantile Malnutrition Research Unit (I.M.R.U.) are given in Appendix I.

(1) KWASHIORKOR

Definition

Kwashiorkor is a form of severe protein-calorie malnutrition occurring in early childhood, usually between the age of 1 to 3 years.

Causation

Main cause. A diet that is very low in protein (especially animal protein), consisting mainly of starchy, principally carbohydrate, vegetable food.

Additional medical causes. Various diseases may also assist in producing kwashiorkor —important examples are *infective diarrhoea* (which prevents absorption of food), *intestinal helminths* (especially hookworm disease in Buganda, which results in blood, and hence protein, loss in the bowel, or heavy infections with the roundworm in some parts of the country, such as Kigezi), and *respiratory infections* (including tuberculosis and whooping cough) which increase the body's need for protein, but produce a poor appetite.

Reasons for inadequate diet. The diet may have been given by the mother for one or more reasons : (i) *poverty* (most animal protein foods are relatively expensive), (ii) *lack*

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* Prepared for the Scientific Committee on Human Nutrition of the Uganda Government.

of knowledge that children need a high protein diet during this stage of rapid growth; (iii) *incorrect ideas* about certain foods (i.e. prejudice against giving milk, eggs, fish or meat to young children for a variety of incorreect reasons).

Special causes. Four especially important situations that may cause a poorly fed child actually to develop kwashiorkor are (i) *lack of breast milk*, if mother dies or is seriously ill, or child is "displaced" from the breast by another pregnancy, or if breast milk (and other food) has to be "shared" as with twins, or if breast milk fails for any reason, as when the mother leaves the child at home while she goes out to work; (ii) *abrupt weaning*, both in the home and especially when the child is sent to stay with grandparents (with resulting misery and poor appetite); (iii) *prolonged starvation or restricted diet* during treatment for diarrhoea; (iv) *family instability*, with mother no longer supported by father owing to separation, illegitimacy or abandonment.

Clinical diagnosis

The clinical signs of kwashiorkor *as seen in Uganda* can be divided into those (I) always present, (II) usually present and (III) occasionally present.

(I) *Always present.* The following signs are always present and are all that are needed to make a diagnosis in a 1-3 year old child who has probably been having a largely carbohydrate diet.

- (i) *Growth failure.* As shown by a low body weight (especially after disappearance of oedema) and a subnormal length.
- (ii) *Oedema.* Swelling of the feet and lower legs due to pitting oedema. Often also involving the hands, lower back and, occasionally, the face.
- (iii) *Wasted muscles with some subcutaneous fat.* Because of the low protein of the diet, the child uses up his own body muscles and generalized wasting occurs and this is sometimes most successfully demonstrated in the middle of the upper arm over the biceps. Some, or even a thick layer of, subcutaneous fat is present, as the child has been receiving some calories from starchy carbohydrate foods.

(II) *Usually present.* One or more of the following signs are usually present, but none are absolutely needed to make a diagnosis.

- (i) *Misery.* Difficult to measure, but shown by a lack of interest and movement, together with a feeble whining cry.
- (ii) *Hair changes.* Lightness of colour (brown, reddish, nearly white, etc.); straightness; sparseness; silkiness; easily pulled out.
- (iii) *Skin pallor.* Whole body may be light reddish-brown. Most marked on, and sometimes confined to, the face.
- (iv) *Loose stools.* From failure of digestion of food.

(III) *Occasionally present.* One or more of the following signs are occasionally present, but none are absolutely needed to make a diagnosis.

- (i) "*Flaky-paint*" *rash.* Dark coloured patches on a background of relatively normal skin, which flake or peel off leaving very light-coloured skin or even ulceration beneath. Can occur almost anywhere, but is often seen on the backs of the thighs and buttocks.
- (ii) *Groin rash.* In kwashiorkor cases in Uganda, a *moist* peeling light-coloured rash is occasionally seen in the groins and uncommonly in the axillae.
- (iii) *Ulcers and cracks.* Small skin ulcers often present, especially over pressure points. May be deep cracks in skin, especially behind and around the ears and in skin folds.

(iv) *Moderate anaemia.* If severe, always due to associated infection with hookworm or malaria.

(v) *Signs of associated vitamin deficiency* (i.e. sore angles of mouth and a purplish tongue from riboflavin lack).

(vi) *Large liver.* Found on palpation, more than one inch below the costal margin. This is rare in children in Uganda.

DIFFERENTIAL DIAGNOSIS

This is usually not difficult, as kwashiorkor is much the commonest cause of oedema in the 1-3 year age group in children in Uganda and most tropical countries.

(i) *Hookworm disease.* Oedema is present, together with severe anaemia (often with signs of heart failure) and with the stools full of hookworm ova. Skin shows generalized pallor, otherwise normal. (May be difficult in some cases when both conditions present at the same time).

(ii) *Nephrosis.* Severe oedema, but no other signs of kwashiorkor and urine full of albumin. Ascites may be present, but never in kwashiorkor.

TREATMENT

Principles. The two *main* principles of treatment are the same in all cases, but the way they can be carried out will vary with the severity of the individual case and with local medical facilities, especially the availability of hospital beds :

(i) *Supply what has been lacking in the diet*—with a high protein diet in a digestible, easily-given form, containing adequate calories.

(ii) *Treat infections*—respiratory, skin, diarrhoea, malaria, hookworm.

(I) *Moderate cases*

These will often have to be treated at home and followed in out-patients or at the clinic.

(1) *Diet.* Dried skimmed milk (D.S.M.) should be supplied to the mother either once or twice weekly, or fortnightly, if local circumstances permit. *Total* daily dosage for the child can be *roughly* estimated as 2½ teaspoonfuls of D.S.M. per lb. body weight per day.

Often distance and timing of clinics may necessitate monthly issue of powdered milk to mothers. D.S.M. is often available in clinics in plastic bags in cardboard boxes, each containing 4½ lbs. D.S.M., which represents about a month's supply for an *affected* child. Mothers must be instructed to close the plastic bag with a string or elastic band every time it is used, as otherwise the powder becomes hard and useless.

As most families eat only twice a day, the mother should be especially instructed to feed her malnourished child three, or preferably four, times daily. At each feed, one-third or one-quarter of the calculated total daily amount of D.S.M. should be mixed in with other foods. Details will vary with the local food pattern. In Buganda, the D.S.M. is often best mixed with the child's sauce* taken at the two main meals eaten with the parents. For the child's third (and preferably fourth) meal, the D.S.M. can be mixed into *katogo* or *mugoyo* (beans cooked with plantain or sweet potato respectively), or into maize porridge (*bwuji*), or into mashed pawpaw, or into any cold food that is left over. (In sicker children with poor digestion and impaired appetite, the semi-solid maize porridge may be found to be more acceptable.)

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* The basic diet in Buganda is *matoke* (steamed plantain) with a sauce or gravy of variable composition (often containing groundnuts and vegetables), and sometimes the addition of small amounts of red beans (*Phaseolus vulgaris*) (*bijanjalo*).

† Various preparations may be available, especially those containing Benzyl (or dibenzyl or benzathine) penicillin, such as " Penadur " (400,000 units per ampoule).

Mothers should not usually be advised to make the D.S.M. into liquid milk, owing to the danger of causing diarrhoea from infection and wrong preparation. In special circumstances, as with very small infants, the method shown in Appendix II can be used.

When the child is thought well enough (or *immediately in very mild cases*), *precise* advice must be given on improving and widening the child's diet based on local foods *obtainable by the mother* (including animal protein foods, such as fresh and dried milk, fish, eggs and meat, and vegetable protein foods, often as mixtures, especially beans). (See later—" Prevention ")

(2) *Infection.* For skin ulceration and probable mild respiratory tract infection, a *single dose of long-acting* penicillin† can be given intramuscularly. When malaria is probably present (fever with no obvious cause, and/or enlarged spleen, and/or marked anaemia, or possibly *all* cases in endemic area), *single dose* chloroquine (2 mg. per lb. body weight) intramuscularly—(1 ml. of the intramuscular chloroquine solution, containing 40 mg. per ml.)—is usually suitable for most cases of kwashiorkor.

(II) *Severe cases*

Severely affected children, as judged by much oedema, severe muscle wasting, marked misery and skin signs, *must be admitted* with their mothers to a reasonably equipped hospital as emergencies.

(1) *Diet.* D.S.M. (prepared as shown in Appendix II), *or*, preferably, the I.M.R.U. Milk Protein Diet (M.P.D.) (D.S.M., casein, sugar, edible "simsim" [cotton seed] oil—prepared as shown in Appendix II) can be used, both in a *total daily dose* of about 2½ fluid ounces per lb. body weight per day, divided into 6 equal feeds given 3 hourly.

Method of feeding. Depending upon the appetite and cooperation of the child, by cup, spoon or by intra-gastric feeds, using a fine plastic polythene tube (at least for the first few days). The latter is very valuable in some cases, as, with careful handling, it is safe, overcoming the child's poor appetite and lack of interest, and is a great saving of nursing time (Appendix III).

Potassium. Body potassium is often low in children with kwashiorkor because of loss in loose stools. In addition, it is needed for the rebuilding of body muscle during recovery. A potassium chloride mixture should be given three times daily, mixed with the feeds, to all cases of kwashiorkor admitted to the ward. Each dose should consist of 0.5 gram of potassium chloride in two drachms (2 teaspoons) of water.

Rehydration. Some cases of kwashiorkor show evidence of dehydration, despite oedema. The majority can be treated by intra gastric drip with half strength Hartmann's solution or occasionally by intravenous fluids.

Iron. Kwashiorkor cases with *marked* anaemia (usually associated with some other cause such as malaria, hookworm or sickle cell anaemia) can be given an initial single intramuscular injection of 2 ml. of iron-dextran compound (" Imferon "), followed by iron by mouth during " Later Treatment ".

(2) *Infection.* (i) Skin ulceration or infection, and/or symptoms or signs of respiratory infection, and in *all* very severe cases, a 5 day course of intramuscular procaine penicillin (single dose of 400,000 units daily).

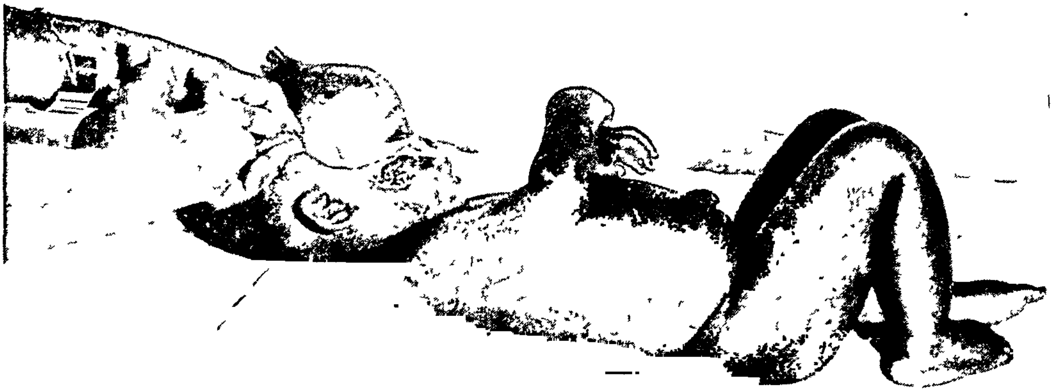

FIG. 1. Kwashiorkor in a 17 month old Ganda boy, showing syringe feeding with M.P.D. through a fine polythene tube. The child shows the following features in the different groups listed in text :
(I) Always present—growth failure, oedema, wasted muscles with overlying subcutaneous fat.
(II) Usually present—misery, hair changes, skin pallor.
(III) Occasionally present—" flaky-paint " rash.
Treatment : M.P.D.—infant diet ; single dose I.M. chloroquine, five days procaine penicillin, oral potassium chloride mixture.
Course : Rapid response, discharged 3 weeks later with D.S.M. and advice on diet.

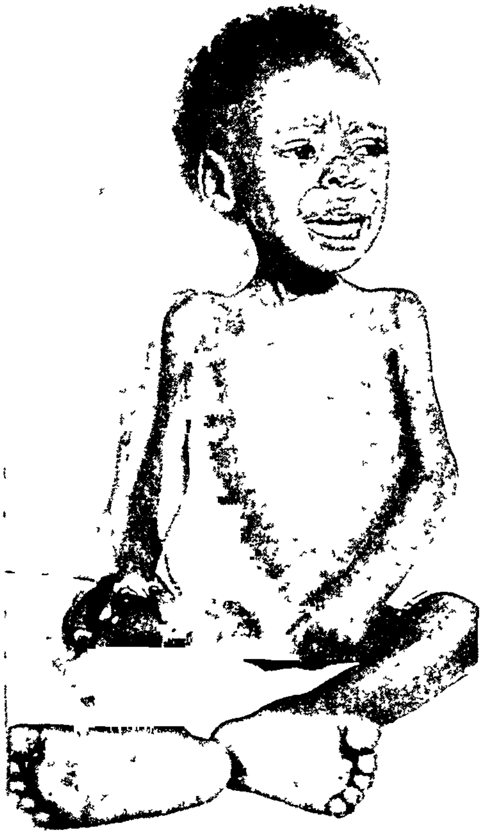

FIG. 2. Nutritional marasmus in a 20 month old *Ganda boy showing the following clinical features:*
(i) Always present—growth failure, wasting of *both* muscles and subcutaneous fat.
(ii) Sometimes present—minor hair changes.

(ii) In highly malarious areas, *single dose* chloroquine (2 mg per lb body weight) intramuscularly to all cases (Usually about 1 ml of intramuscular solution, containing 40 mg per ml, is needed)

(iii) If *mild* diarrhoea, no special treatment needed If more severe, a course of sulphaguanidine (daily dose 0 1 gm per lb body weight), or chloramphenicol suspension (daily dose 25 mg per lb body weight), orally or by tube, divided into four equal doses given six hourly, for five days or until diarrhoea stops

(iv) If hookworm *disease* (as shown by severe anaemia and very many hookworm ova in the stools), try to raise haemoglobin with intramuscular iron (" Imferon ") or by a slowly-given blood transfusion, if available

Deworm when general condition and haemoglobin commencing to show improvement, using a calculated dose of tetrachlorethylene 0 05 ml (3/4 minim) per lb body weight (maximum 5 ml), *given on an empty stomach, with no preparation and no purgation* (Oil of chenopodium is best not used in the treatment of hookworm, owing to its toxicity)

(v) Treat other infections as indicated (e g tuberculosis)

Later treatment

Once recovery has commenced (oedema beginning to disappear, child taking interest in surroundings, initial weight loss, followed by gain)

(i) the diet should aim at filling the child with the protein his body needs, showing the mother that improvement is due to better nutrition, and educating her to make the best use of locally available foods, including D S M , when she returns home (both for the present and future children) These aims can be best achieved by gradually introducing a mixed diet, high in protein and vitamins, suitable for a young child and based on local foods ,

(ii) iron by mouth Uganda Formulary—Iron Mixture (Children's) containing Ferrous Sulphate 60 mg per drachm Dose dr 2 (2 teaspoonfuls) twice daily ;

(iii) treat various minor infections, if such are present (including the roundworm infection often found especially in Banyaruanda children) using single dose piperazine (75 mg per lb body weight, maximum 3 grams) on an empty stomach with no preparation and no purgation ,

(iv) in highly malarious regions, protect child with ½ tablet (75 mg base) chloroquine once weekly for three months after discharge ,

(v) if possible, seek cooperation and assistance of local chief or Social Welfare Officer where there has been a family breakdown

(II) NUTRITIONAL MARASMUS

Definition

Nutritional marasmus is a form of severe protein-calorie malnutrition usually occurring in the first three years of life (It differs from kwashiorkor in age incidence in that it occurs usually in the first year of life)

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Causation

Main cause. Starvation, that is a diet lacking *both in protein and in calories.*

Additional medical causes. The commonest are *infective diarrhoea* and *tuberculosis.*

Special causes. Two additional causes are of especial importance :

(i) *Failure of breast-feeding*—as a result of death of mother, abandonment of the child, or actual failure of breast-milk (often leading to *nutritional marasmus* from inability to afford to buy adequate milk and lack of knowledge of how to prepare feeds of right strength, and to *infective diarrhoea* as a result of using contaminated unclean feeding utensils).

(ii) *Starvation as treatment.* Sometimes nutritional marasmus may be produced by *over-prolonged starvation* of children with an initial infective diarrhoea. Children should have their diet restricted for as short a time as possible, and not longer than 24 hours.

CLINICAL DIAGNOSIS

(I) *Always present*

(i) *Growth failure.* As shown in body weight and length. (The weight is often extremely low).

(ii) *Wasting of BOTH muscles and subcutaneous fat* as the diet has been low in calories, as well as protein. In severe cases, the face is involved to give a wizened " little old man " appearance.

(II) *Sometimes present*

(i) *Loose stools.* Often from associated infective diarrhoea.

(ii) *Hair changes.* Similar hair changes to kwashiorkor can occur but are much less striking. *Very light coloured* hair is quite unusual.

(iii) *Signs of associated vitamin deficiency.*

(iv) *Anaemia.*

(v) *Dehydration.* From associated diarrhoea.

Comparison with kwashiorkor

In contrast to kwashiorkor, children with nutritional marasmus are (i) often under 1 year old, (ii) thinness and wasting are obvious, (iii) oedema is absent, (iv) hair and skin are usually a normal colour, (v) no " flaky paint rash " or other skin signs are present, (vi) misery is not marked, (vii) the appetite is usually good.

Treatment

As for kwashiorkor, except that *infective diarrhoea* is more often present and, if severe, may require (a) an initial *short* period of dietary restriction, and (b) if dehydration is found, fluids given by gastric tube, subcutaneously or intravenously.

As compared with kwashiorkor, infants with nutritional marasmus (i) are less likely to develop diarrhoea with D.S.M., (ii) often show a very slow progress with treatment sometimes taking weeks before starting to grow well.

(III) INTERMEDIATE CASES

While most cases of protein-calorie malnutrition in early childhood can be easily recognised as belonging to the two clinical types described (i.e., kwashiorkor and nutritional marasmus), some cannot (e.g. child with nutritional marasmus with very slight oedema, etc.). These intermediate cases require the same general approach and treatment as laid down for kwashiorkor.

PREVENTION

(I) *Long-term* This will be concerned with the wide activities concerned with :

(i) *improving the country's food supply* (especially animal protein foods, such as milk, fish and meat, and vegetable protein foods, such as legumes, and relatively high protein carbohydrate foods, such as millet) ,

(ii) *improving the economic level of the country*, and the money available to people to buy foods ;

(iii) *improving the general level of education*, so that parents, especially mothers, understand the importance of the correct feeding of their children ,

(iv) *improving the medical facilities*, including child welfare clinics

(II) *Immediate* For the practical worker, the immediate concern is the prevention of protein-calorie malnutrition in young children under their care or supervision

Methods In general two main overlapping methods are available

(i) *Health education*—that is the teaching and influencing of all sections of the community, especially fathers and mothers, to employ to best advantage the foods available to them, and to make use of child welfare clinic facilities, if available This should form part of all activities concerning children (i e for mothers in hospital with their children, in clinics, in health centres, in outpatients, etc), during home visiting undertaken by Health Visitors Community Development workers, etc , and by such other means as broadcasting, booklets and leaflets Particular attention will have to be given to the value of breast feeding, incorrect local ideas about kwashiorkor, weaning foods, and family budgeting in relation to the child's needs

(ii) *Supply of special infant food* This may take the form of D S M or various inexpensive locally produced high protein infant foods (often based on a mixture of vegetable protein foods and D S M) * Methods of preparation will have to be explained It is usually best to issue the D S M for mixing with local dishes Special categories, such as twins, may have to be given particular priority

The balance of these two activities will vary from area to area In some areas, it may be judged that a supply of special infant food, such as D S M , should be made available at child welfare centres for the majority of poorer parents (either free or at a cheap rate) A disadvantage of this can sometimes be that the centres no longer have time for health education activities The distribution of special infant food must always be accompanied by health education directed towards the use of local foods

In more favoured areas (economically, agriculturally, or as regards fisheries), it may be decided to concentrate on health education activities and to reserve the issue of special infant food for children who are considered to be in special need (as judged by failure to gain weight)

Methods of health education In general these are more likely to be successful if they are mainly taught by female staff of the same group as the mothers (preferably married with healthy children of their own) in the local language and in the form of practical demonstrations with local foods, cooking utensils and kitchens, with mothers actually taking part and joining in any discussion

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* One of which, containing D S M , groundnuts, and other ingredients, is under trial by the I M R U

PRACTICAL PLAN

(1) *First six months of life.* If early breast feeding is carried on satisfactorily (as is usual in rural areas), there is no need for any other food at all except breast milk for about the first six months of life unless there are special circumstances, such as a poor flow of milk or failure to gain weight normally, or in the case of twins.

Every effort must be made to carry on breast feeding, especially during the first six months. Artificial feeding should never be recommended unless really necessary.

(2) *After six months of age.* The following practical plan, known as the " 3-plank bridge " has been found useful (D.B.J.). It is based on the idea that a nutritional " bridge " has to be made to carry the children over the dangerous 1-3 year period. The three planks are as follows :

(i) *Use all available animal protein.* Although usually animal protein is both expensive and in short supply, efforts must be made to encourage mothers to use *all* available supplies, including fresh or dried milk, fish, eggs, meat and even possibly (if specially cooked) such minor items as white ants.

The more digestible of these should be introduced first. Various food attitudes and prejudices may have to be overcome, if possible. It is probable that, in many cases, insufficient animal protein foods will be available to cover the child's needs. However, *even very small extra amounts* are of importance.

(ii) *Vegetable protein mixtures.* While the first semi-solid food given (as all over the world) is usually a gruel or paste prepared from a starchy carbohydrate staple, this should soon be followed by a gruel or paste made of a mixture of locally available vegetable foods. This mixture will normally be based on a cereal (e.g., millet, maize, rice, etc.) and a legume (e.g., beans or peas). (In Buganda, where cereals are not eaten for preference, the best mixture is probably one of sweet potato and red beans, such as the traditional mash known as *mugoyo.*) How these mixtures are to be prepared, suitable recipes, and the proportions to be used, will have to be worked out locally. Often one can start with a 3:1 (cereal or carbohydrate staple to legume) mixture and gradually increase to 1:1. The value of these mixtures is improved very greatly by the addition of even small amounts of dried or fresh milk.*

As soon as possible after the introduction of this type of vegetable protein mixture infant food, the diet should be widened to include as much as possible of the local diet (with especial relation to other food factors, such as vitamin C, carotene and iron).

(iii) *Prolonged breast feeding.* Breast feeding prolonged into the second year of life is the traditional and historical way of feeding human babies.

The milk of even poorly-fed African mothers in late breast-feeding is *normal in protein content* although small in quantity.

For mothers in the poorer socio-economic groups (among whose children kwashiorkor occurs), prolonged breast-feeding is to be encouraged (up to 1 or 2 years, depending upon the local customary pattern—providing another pregnancy does not occur and the mother is otherwise medically fit) as it supplies a small, but valuable, extra amount of protein to the child

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* Various recipes, widely used by Community Development workers etc. in Buganda, are given in Dr. H. F. Welbourn's booklet " *Endiisa Enungi ey'Omwana* " (" How to Feed Your Child ".) (E. Africa Literature Bureau Sh. 1/-). They include bean purée and various egg dishes prepared with the addition of small amounts of D.S.M.

Prolonged breast feeding *must never be carried on by itself* but always together with other foods as suggested in (i) and (ii) In addition, detailed advice must be given to the mother in order to improve her own diet during the period of prolonged breast feeding, especially with local dishes prepared from foods rich in vegetable proteins

APPENDIX I AVERAGE WEIGHTS OF HEALTHY BAGANDA CHILDREN *

Age (months)		1	2	3	4	5	6	7	8	9	10	11	12
Weight (lbs /oz)	Boys	9/11	12/0	13/12	15/3	16/7	17/8	18/6	19/4	20/0	20/11	21/4	21/13
	Girls	9/7	11/9	13/1	14/5	15/8	16/8	17/5	18/2	18/13	19/8	20 1	20/10

Age (months)		13	14	15	16	17	18	19	20	21	22	23	24
Weight (lbs /oz)	Boys	22/5	22/13	23/5	23/12	24/3	24/8	24/14	25/4	25/9	25/14	26/3	26/8
	Girls	21/2	21/10	22/1	22/7	22/14	23/4	23/10	24 0	24/5	24/10	24 15	25/4

Age (months)		25	26	27	28	29	30	31	32	33	34	35	36
Weight (lbs /oz)	Boys	26/12	27/0	27/5	27/10	27/14	28/1	28/5	28/8	28/12	29/0	29/4	29 7
	Girls	25/8	25/13	26/1	26/5	26/9	26/13	27/2	27/6	27/11	27/15	28/4	28/8

APPENDIX II DRIED SKIMMED MILK AND THE I M R U MILK PROTEIN DIET

(1) *Dried Skimmed Milk*

To make full strength D S M in hospital mix 6 oz powdered milk and 1 oz sugar with 40 ozs boiled water

On the *rare* occasions it is to be prepared by mothers at home, quantities must be expressed in terms of cups and spoons known by the mother These should be available in the clinic for demonstration purposes One "normally heaped" average teaspoon contains 1/6 oz D S M A convenient approximate method for unsophisticated mothers in outpatients is to advise 1 teaspoon (as described) to the fl oz or 20 to the pint, without sugar

(2) *I M R U Milk Protein Diet* (*M P D*)

Preparation Add 10 oz casein powder to 12½ oz D S M and 10 oz sugar Mix thoroughly and store in powder form in a tin with a tightly fitting lid

When required, add 1 fl oz edible simsim (cotton seed) oil to 3 oz powder mixture, *gradually* stirring well with a spoon Then add 40 oz warm boiled water *gradually* stirring well to avoid lumps. Whisk very well. Pour into labelled jug and leave covered. Careful attention must be given to cleanliness of feeding utensils. M.P.D. is high in protein, easily digestible, less likely to produce diarrhoea than D.S.M. and contains about as many calories (20 per fl. oz.) as full cream milk. It speeds up recovery in protein-calorie malnutrition, thereby shortening hospitalization, and only has the disadvantage that casein (pure milk protein—available commercially as the Glaxo preparation " Casilan ") slightly increases the cost of feeds.

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* Based on longitudinal studies carried out by the I M R U

APPENDIX III. TUBE FEEDING

Polythene tubing* (size 2, diameter 1 mm.) can be employed for intra-gastric feeds for severe cases of protein-calorie malnutrition.

The required length of tubing (usually 18-24 inches) can be roughly estimated by measuring the distance from the front of the child's hair in the mid-line to the lower end of the sternum and doubling it. It is not necessary to sterilize new tubing before the first feed. The end of the tube should be smoothed by rubbing on sandpaper or by applying the flame of a match for a second.

The tube is lubricated with water and passed through a nostril into the nasopharynx and stomach. The tubing can be fixed across the cheek in the direction of the ear with pieces of strapping. It can be left in place for several days, or even up to a week, because it is narrow and does not cause irritation.

Syringe. Three-hourly feeds can be given slowly by a syringe through an injection needle which fits the tube (size 18 B.W.G.). Initially and before each feed, the tube should be tested with a little boiled water. The child's arms should be splinted between feeds to prevent removal of the tube.

Polythene tubing becomes soft when immersed in hot water. It must be removed carefully from the boiling water, as pressure while hot causes flattening of the tube. It must be boiled for *one minute only* as otherwise it becomes hard after removal from the water.

Continuous drip. Feeds can be given continuously by attaching the tube to a " drip " giving-set, the bottle of which contains the D.S.M. or M.P.D. The mother or some other assistant should always be present. In hot weather, the feed is likely to go sour and the bottle should be changed six-hourly.

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* Available commercially from Messrs. Allen and Hanburys, Ltd., Bethnal Green, London, E.2 in boxes containing 100 yards of tubing, costing Shs.25.00. Polythene tubing can also be used intra-gastrically for feeding premature infants and for giving fluids to moderately dehydrated children with gastro-enteritis.

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EDITORIAL

ORAL POLIOMYELITIS VACCINE

Possibly partly as a result of slowly improving environmental hygiene, poliomyelitis, usually widely endemic in tropical regions, is almost predictably emerging, or has already emerged, in an epidemic form principally affecting indigenous children in the early years of life.

Under these circumstances the question of mass immunisation with one of the two available types of vaccine becomes very relevant and has to be considered in relation to certain ecological conditions peculiar to the present-day tropics.

Thus, the Salk vaccine is of rather limited usefulness for mass purposes because of expense, the probably short-term immunity achieved, and especially the organizational impossibility of multiple inoculations for individual children.

Consideration of the pros and cons of Sabin or Koprowski types of oral live vaccine are, then, even more important. They are easy to administer *en masse* by some form of throat spray, have been used for many millions of persons all over the world, and are cheap. The only theoretical disadvantage is the question of back-mutation to a virulent form, although there is no evidence of this in huge field trials.

A practical consideration is, or course, the actual availability of the oral vaccine, containing if possible all three types of polio-virus, on a commercial scale, and, at present, it would seem that few companies are in a position to supply large quantities. However, this is in the process of being changed and by 1960-61 it seems likely that large-scale supplies will be at hand.

In this case, countries where poliomyelitis is known to be hyperendemic, with a constant trickle of cases occurring at all times, will be faced with the problem of whether to carry out a campaign to prevent epidemics in the future or to wait until an epidemic actually occurs. General considerations based on accepted public health principles would suggest the former alternative, with emphasis in the campaign given to especially vulnerable groups, including indigenous pre-school children.

EXCERPT

A NEW FAMILIAL ABNORMALITY OF RED BLOOD CELLS

(LEADER. *Lancet*, 1960, **1**, 37).

This summary reviews knowledge of a recently detected enzyme deficiency of red blood corpuscles which appears to be common in parts of Africa and is associated with an increased sensitivity to various substances, including primaquine. It seems likely that this type of abnormality may be relevant to numerous previously unexplained types of haemolytic anaemia, including, for example, favism.

SERIAL ELECTROPHORETIC STUDIES ON THE SERUM PROTEINS OF MALNOURISHED JAMAICAN INFANTS DURING TREATMENT*

by

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A number of changes have been reported in the serum proteins of malnourished infants. Reduction in total protein mainly due to a low serum albumin has been generally recorded (WATERLOW, 1948 ; DEAN and SCHWARTZ, 1953 ; SCRIMSHAW, 1956) A raised gamma globulin (ANDERSON and ALTMAN, 1951) and a raised alpha globulin (SCRIMSHAW, 1956) have also been observed WENT and GANDASOEBRATA (1955) have suggested that in malnutrition the gamma globulin is maintained at a constant level by the body at the expense of other plasma proteins. It was thought profitable to investigate whether these findings could be confirmed in malnutrition as found in Jamaican children For comparison electrophoretic patterns from 55 normal adult Jamaicans were used as it was not possible to obtain blood from definitely normal infants of comparable age.

MATERIALS AND METHODS

Fourteen children admitted between January and November, 1957 to the Medical Research Council Ward, with varying degrees of malnutrition, were investigated. The average age on admission was 13 months (range 3-20 months) and their average stay in hospital was three months The children were fed on a diet composed of skimmed milk, sugar and peanut oil with fruit juice and cod liver oil An analysis was made of the serum proteins by electrophoresis on filter-paper during the child's stay in hospital

For paper electrophoresis a horizontal bath was employed at a constant temperature of 21°C using barbiturate buffer[1] pH 8 6 (μ = 0 025) 10 μ of serum was applied to the wetted strips (Whatman No 1, 1½") and a direct current of 200V, corresponding to about 0 3 mA per 1½ inch strip, was passed for 16 hours The proteins in the strip were fixed by heating at 100°C for 15 minutes and stained with light green (DANGERFIELD and SMITH, 1955) By means of a photoelectric scanner a graph was obtained The areas under the graph, *corresponding to the various protein fractions, were quantitated by planimetry* As a comparison the total proteins and albumins were estimated by the salting-out technique (0 2 mls serum + 4 mls sulphate-sulphite solution,[2]) combined with the biuret method

RESULTS AND DISCUSSION

Malnourished Infants. Fig. 1 and Table I show that the most important change of the plasma proteins in the malnourished children on admission is the highly significant reduction of the albumin fraction, which on discharge has already reached a higher level than in normal adults. In Fig. 2 the average of the changes in proteins during treatment of five of the patients is shown. These five were selected since they were longer in hospital and each had regular blood specimens taken for investigation.

From this figure it is apparent that the albumin reaches its maximum long before the patient is clinically well enough to be discharged

An attempt was made to show whether this behaviour of the albumin was true for the group as a whole. Since there were not frequent enough blood specimens available

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* [illegible] by a grant from the Rockefeller Foundation.

[1] [illegible] sodium barbital in 1 litre distilled water.

[2] [illegible] 1 litre distilled water.

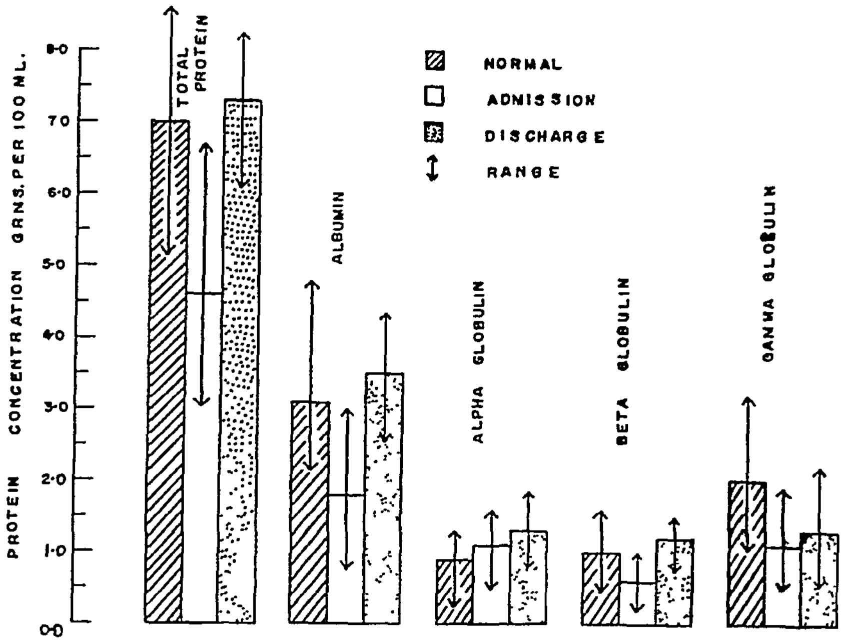

Fig. 1. Average Figures for the Serum Proteins of Normal Adults and Malnourished Infants.

TABLE I. Average Figures for the Serum Proteins of Normal Adults and Malnourished Infants (range given in brackets).

	Biuret method		Electrophoresis
Jamaican normals (N = 55)			
Total proteins	7.0 (5.2—8.6)		
Albumins	3.0 (1.4—4.6)		3.1 (2.2—4.8)
Globulins	4.0 (2.2—6.0)	Alpha	0.9 (0.3—1.3)
		Beta	1.0 (0.5—1.6)
		Gamma	2.0 (1.1—3.2)
Malnourished infants on admission (N = 14)			
Total Proteins	4.6 (3.1—6.7)		
Albumins	1.8 (1.1—2.8)		1.8 (0.8—3.0)
Globulins	2.8 (1.8—3.2)	Alpha	1.1 (0.5—1.6)
		Beta	0.7 (0.3—1.0)
		Gamma	1.0 (0.5—1.9)
Malnourished infants on discharge (N = 14)			
Total Proteins	7.3 (6.1—8.5)		
Albumins	3.6 (3.1—4.0)		3.5 (2.6—4.3)
Globulins	3.7 (3.1—4.5)	Alpha	1.3 (0.8—1.8)
		Beta	1.2 (0.8—1.5)
		Gamma	1.3 (0.6—2.2)
Probability levels			
	Admission/discharge	Normal/admission	Normal/discharge
Total Proteins	<0.01	<0.01	0.15
Albumins	<0.01	<0.01	0.05
Globulins Alpha	0.05	0.05	0.10
Beta	<0.01	<0.01	0.10
Gamma	0.20	<0.01	<0.01

on all these cases only three points could be plotted (Fig. 3). These were the average of the initial estimations on admission, the last estimation before discharge, and an intermediate point at which the albumin had already reached its maximum level. The average time for this on all 14 patients was found to be 17 days with a range between 10 and 40 days.

Thus it is seen that the early recovery of the low serum albumin of malnourished children precedes very markedly the clinical recovery of the patients, which can be judged amongst other factors from the weight gain (Fig. 3). This is true both for the average figures on the five more severely malnourished children and for the group as a whole. In the first instance the five children started off with an albumin level of 1.2 g/100 ml (Fig. 2), which reached its maximum after 30 days, or roughly half the period of their stay in hospital. The average for all 14 cases, which started off at an albumin concentration of 1.8 g/100 ml. (Fig. 3) reached the maximum in 17 days, also about half the period of their stay in hospital (39 days).

Practically the whole increase in total proteins (Figs. 1 and 2, and Table I) can be explained on the basis of the aforementioned increase in albumin. There remains, however, some increase (partially significant) in all the globulin fractions, mainly in the first 20-30 days. The simplest explanation seems to be that the blood volume is increased

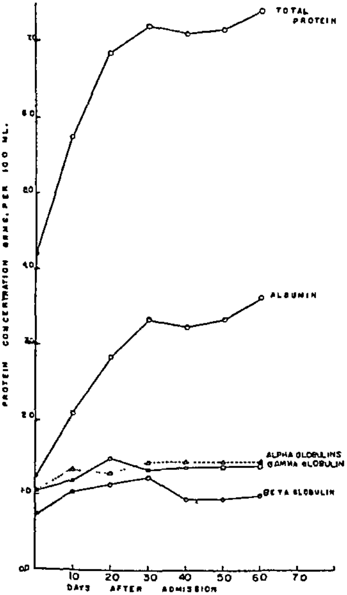

Fig. 2. Changes in Serum Proteins during Treatment (Average of five patients).

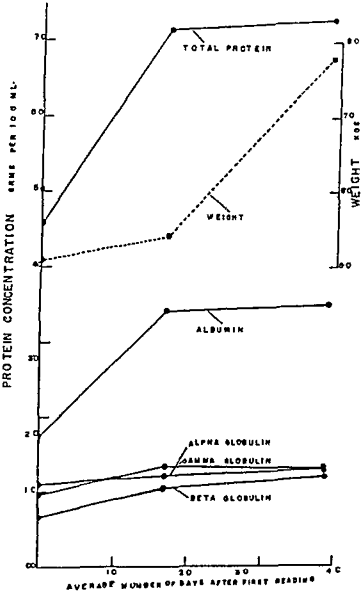

Fig. 3. Changes in Serum Protein during Treatment (Average of all fourteen patients).

TABLE II. Reported Normal Serum Protein Figures.

Source	Race	No.	Method	Total Protein	Albumin	Globulins Alpha 1	Globulins Alpha 2	Globulins Beta	Gamma	References
U.S.A.	Caucasians	185	Paper electrophoresis	7.30	5.00	0.21	0.53	0.66	0.88	Jencks et al (1956)
Uganda	Caucasians	30	Chemical (Wolfson et al 1948)	7.31	4.25	0.91		1.09	1.03	Holmes et al (1951)
Nigeria	Caucasians	25	Paper electrophoresis	6.9	4.05	0.31	0.52	0.82	1.20	Edozien (1957)
Belgian Congo	Negroes (European std. of living)	21	Paper electrophoresis	6.65	4.08	1.41 (Alpha + Beta)			1.16	Oye and Charles (1957)
Great Britain	Negroes 0-2 yrs. in U.K. 2-4 ,, 4-8 ,,	10 10 10	Paper electrophoresis	7.69 7.24 7.51	3.47 3.47 4.23	0.24 0.22 0.20	0.76 0.53 0.53	1.02 0.98 0.95	2.20 2.04 1.60	Schofield (1957)
Uganda	Negroes	30	Chemical	7.60	3.27	1.60		0.76	1.98	Holmes et al (1951)
Nigeria	Negroes	50	Paper electrophoresis	6.80	3.35	0.20	0.51	0.64	2.10	Edozien (1957)
India (Bombay)	Indians	100	Paper electrophoresis	7.70	4.52	0.19	0.32	0.81	1.81	Satoskar and Lewis (1954)
Venezuela	Indians Negroes Caucasians	80	Paper electrophoresis	7.30	4.02	0.27	0.55	0.83	1.63	Jorge-Vera and Roche (1956)
Jamaica	Negroes	(A) 14 (B) 41	Paper electrophoresis	7.7 6.7	3.8 2.8	0.2 0.3	0.6 0.6	1.1 1.0	2.0 2.0	This paper

about 20% in undernourished children, a conclusion drawn from the work of Gomez et al (1954) This excess of fluid would quickly disappear during treatment, causing a relative increase of all the blood constituents

Normal Adults In collecting Jamaican normals it became apparent that the sample could be split into two groups, depending on the source Group A (see Table II) was composed of students and voluntary blood donors, Group B of student nurses who had just been recruited from various parts of Jamaica The average gamma globulin was high in both groups with, however, a very marked variation (Table I, Fig 1) and is consistent with figures reported for other tropical countries This can be explained by the work of Satoskar and Lewis (1954) who reported for Indian medical students a correlation between the dietary protein source and the level of gamma globulin The albumin of the Jamaican normals is significantly lower in Group B than in Group A This is probably due to a lower standard of living and to qualitative and quantitative differences in the intake of proteins The findings in Group A were actually not very different from the generally accepted normal figures, with the exception of the high gamma globulin Our impression is that this same high gamma globulin occurs also in Europeans whoare temporary residents in Jamaica There is, however, often a considerable discrepancy between the figures for "normal" serum proteins from tropical countries and those which are reported from temperate regions (Table II) We can suggest at least three reasons for these discrepancies (a) the comparison of results obtained with filter-paper electrophoresis by various workers is very difficult, due to the many sources of error, especially in the trailing of protein fractions on the paper and in the staining of the paper ; (b) the environment (nutritional or otherwise) of the population groups studied is often not comparable , this is well illustrated by the comparison of our groups A and B , (c) genetic racial differences may be present

Rawnsley et al (1956), protagonists of this last point of view, found significant differences for gamma globulin and albumin figures from a Caucasian and Negro population in North America Both groups were living in a similar environment in a region where there is no general malnutrition or endemic disease A large part of the groups was born and had always lived in the same area The workers concluded that the differences which they found were due to a genetic factor The existence of such a racial factor has been largely disproved as far as Africans and Caucasians are concerned by the work of Oye and Charles (1957) and Schofield (1957) Oye and Charles studied Africans enjoying a European standard of living in Leopoldville, while Schofield investigated the serum proteins of Africans after they had settled in England These workers showed that the tropical protein pattern can eventually be changed by environmental conditions to that of a temperate region However, it is perhaps worthy of note that the recent subdivisions of globulins by starch gel electrophoresis have indicated that there may be racial differences (Harris et al, 1958) These subtleties of division will however not affect the globulin figures obtained by electrophoretic analysis on paper

Waterlow (1948), and Dean and Schwartz (1953) discussing investigations of serum proteins in fatty liver disease and in uncomplicated kwashiorkor, and Scrimshaw (1956) reviewing the characteristics of kwashiorkor, reported a reduction in total proteins mainly due to a low serum albumin This is confirmed in Jamaican children where the albumin is shown to be significantly low on admission and to increase rapidly within 10-40 days of treatment That the albumin on discharge is higher than the Jamaican "normal" can be explained by the preponderance amongst the normals of Group B material (Table II) The low albumin on admission may be due to a reduction in synthesis

(Gitlin et al, 1948). This would suggest on one hand an insufficient quantity and quality of proteins in the food, and perhaps as a consequence of this, a reversible pathological condition involving the liver, since this is the site of albumin formation. Infection due to parasites may in some areas also be a contributing factor. The malnourished infants have a gamma globulin level which is significantly lower than in the normal adults and does not change markedly during treatment. This can be explained on the basis of the work of Close (1955) in Africa and Payne and Forsyth (1958) in England who found that the gamma globulin is lower in the child than in the adult. The absence of change during treatment supports the suggestion by Went and Gandasoebrata (1955) that in malnutrition the gamma globulin is maintained at a constant level by the body at the expense of other plasma proteins.

In acutely ill children Anderson and Altman (1951) found that the gamma globulin was raised and Scrimshaw (1956) reported a raised alpha globulin. The fact that these changes do not occur in Jamaican children would suggest that there are differences between the malnutrition in Jamaica and the disease as found by the aforementioned workers in South Africa and Guatemala. The most important factors causing differences are likely to be variations in diet, duration of the malnutrition and age incidence.

Summary

An analysis of the serum proteins of a group of Jamaican malnourished infants by means of paper electrophoresis has been made during the course of treatment in hospital. The results are compared with figures obtained on normal Jamaican adults and with published findings from other tropical countries. The implications of observed differences are discussed.

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A PERFORATED AMOEBIC LIVER ABSCESS WITH EMPYEMA IN A CHILD OF 2 YEARS

by

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CASE REPORT

A two-year old Burgher girl was admitted to the Children's Hospital, Colombo, on 27/3/58, with a history of fever of five days duration The onset had been acute and the temperature ranged intermittently between 99 102° F throughout the five days The child had been treated by a private practitioner, but, as there was no response to therapy, she was admitted to the Hospital The fever was not accompanied by any rigor, convulsions, vomiting, diarrhoea or dyspnoea Ten days prior to the onset of the pyrexia, the child had had diarrhoea, which had lasted for seven days There had been about six watery stools daily containing blood and mucus

On admission, the child's temperature was 99 8° F and her weight 21 lbs She was well nourished The conjunctivae were not icteric or muddy The tongue was coated and dry, but the throat was not congested There was no neck rigidity and Kernig's sign was negative The child was dyspnoeic and the alae nasi were working There were signs of an effusion at the right base of the lung , while the left side of the chest showed nothing abnormal on examination

The apex beat was just outside the left midclavicular line There were no other abnormalities of the cardiovascular system The abdomen was distended The liver was tender and palpable 3 fingerbreadths below the costal margin, but there was no intercostal tenderness, nor were there any signs of intestinal obstruction The temperature and dyspnoea continued to increase and two days after admission there was intercostal tenderness on the right side On the 3rd day after admission, a diagnostic aspiration of the liver was done and 15 20 ml of creamy pus were aspirated, but the aspiration had to be discontinued at this stage as pure blood was withdrawn into the syringe

On the following day, the whole of the right side of the chest developed signs of an effusion and the apex beat was localized at the left anterior axillary line As the dyspnoea continued to increase, an aspiration of the right pleural cavity was done, 90 ml of seropurulent fluid were aspirated In the last three days of her life, she developed diarrhoea, passing 4-5 watery, mucus containing, offensive stools without any blood, and showed signs of dehydration

On the sixth day after admission, the child's temperature rose to 106° F and she died 144 hours after entering hospital A few hours before she died, the liver was aspirated again but no pus was withdrawn

Treatment On the day of admission, the child was given intravenous and oral chlortetracycline Fom the second day onwards she was given intravenous and oral oxytetracycline, chloroquine and emetine for two days Subsequent to this the child received penicillin, streptomycin and sulphadiazine together with intravenous N/4 saline and 5 per cent glucose

Laboratory investigations Three consecutive stool cultures were negative for *Entamoebae histolytica* Whipworm ova were seen in the smear Culture of the pus from

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the pleural cavity, as well as from the liver, was sterile. On direct smears, no organisms or amoebae were seen, but plenty of pus cells.

The white blood count and differential showed : total 8,200 per c.mm., polymorphs 35 per cent., lymphocytes 65 per cent. The serum bilirubin was 1 mg./100 ml.

Radiological examination. This revealed a pleural effusion at the right base, with an elevated right leaf of the diaphragm.

Post-mortem findings : An autopsy was done 75 minutes after death. There was an empyema of the pleural cavity which contained about 100 ml. of sero-purulent fluid. The whole of the right lung was collapsed and compressed except for the upper lobe. The left lung showed compensatory emphysema. There was an abscess on the antero-superior surface of the right lobe of the liver near the boundary between the two lobes (Fig. 1).

The abscess cavity was about 2½" x 1½" and was lined by a necrotic, yellowish-white slough which could be scraped off easily, leaving apparently healthy liver tissue. A collection of pus was present under the diaphragm and a fresh blood clot was present in the peritoneal cavity.

The right cusp of the diaphragm abutting the abscess was deficient and had a ragged margin. The pleura was thickened and the lower lobe of the right lung consolidated. These appearances confirmed that there had been an antemortem perforation of the abscess through the diaphragm into the pleural cavity.

Microscopical findings (Professor W. A. Karunaratne). A section of the liver three inches away from the abscess showed normal hepatic cells with no pathological changes. Several portal tracts were inspected, but no amoebae were found. A section of the abscess wall showed that the inner layer consisted of a zone of necrotic cells with compact pyknotic nuclei. There was no evidence of any cell membranes or cytoplasm. No amoebae were seen. Bordering this was a zone of inflammatory cells consisting mainly of plasma cells, lymphocytes, fibrin and young fibroblasts. Beyond this was an area of increased connective tissue and vascularity. The liver cells were separated in groups of two or three or more. External to this area, there was a slight increase in the fibrous tissue round the portal tracts with bile duct hyperplasia and cell infiltration. The outermost part of the section showed normal liver cells. These appearances are diagnostic of an amoebic liver abscess even in the absence of the appearance of the *E. histolytica.*

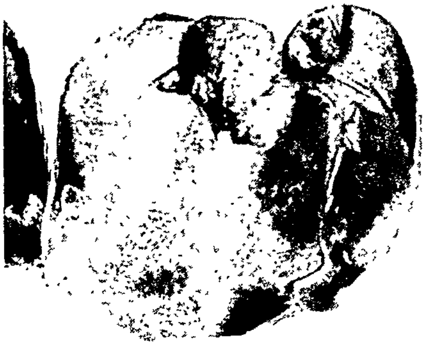

FIG. 1. Autopsy appearance of liver, showing abscess on the entero-superior surface near the left lobe.

The pleura was thickened with a purulent exudate on the outer surface. The underlying lung showed pneumonic consolidation. The diaphragm showed evidence of inflammation.

DISCUSSION

Although amoebic dysentery is common in childhood and not uncommon even in infancy, the occurrence of liver abscess is rare in children as opposed to adults Prior to 1941 Karunaratne (1941) stated that only 9 cases had been reported In 1949, De Silva stated that three additional cases had been reported since 1941 Two of these were reported by Osburn (1944) and one by Arguirre and Riviera (1944), from Capetown and Chile respectively Five cases have been seen post-mortem at the Children's Hospital, Colombo since 1952, but these have not been published

Debakey and Ochsner (1950), reviewing a series of 263 cases of hepatic amoebiasis, found that 177 of these had hepatic abscesses, but only two of these patients were under 9 years, the younger being 6 years of age

An eleven month old infant from India was reported by Niblock (1911) to be suffering from amoebic liver abscess A five year old Chinese girl and three Korean children were also said to have had hepatic abscesses by Sweet (1934), and Ludlow (1926) respectively Soragni (1949) and Tupas et al (1951) have also reported cases of amoebic liver abscess in children Smith et al (1955) described a liver abscess that had occurred in a seventeen month old American infant A four month old Indian infant was also found to have an amoebic liver abscess by Wagle et al (1958) So that this makes a total of 29 cases of amoebic liver abscess occurring in infancy and childhood including the present case

There are a number of interesting features in this case Firstly, the child had only one attack of diarrhoea with blood and mucus prior to her fatal illness Secondly, the pus that was aspirated from the liver at the first attempt was creamy in colour, and not the classical anchovy-sauce described in textbooks In fact, this was one reason why an amoebic aetiology was not primarily considered Furthermore, no pus was aspirated at all at the second attempt in spite of the large abscess cavity that was present This was because it was situated on the antero-superior surface near the left lobe which often produces negative results on aspiration Repeated examinations as well as culture of the fresh pus revealed no amoebae which confirms the already well-known finding that the pus in an amoebic abscess consists only of necrotic liver tissue and pus cells and does not usually contain any *Entamoeba histolytica*

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A CASE OF AMOEBIC GRANULOMA OF THE CAECUM WITH AN ACUTE APPENDICULAR ABSCESS IN EARLY INFANCY

by

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CASE REPORT

A female Tamil child, 4 months of age, whose home was situated in a shanty within the Municipal limits of Colombo, was admitted to the Lady Ridgeway Hospital with a history of diarrhoea of five days, and vomiting of 2 days duration. The child's illness had commenced with 4-5 watery stools daily which contained blood and mucus. Prior to this illness, she had had only one well-formed stool containing no blood nor mucus. On the third day of the illness, the child vomited twice, but subsequently every feed was brought up. The vomitus was neither blood nor bile stained.

Examination. The child's nutrition was found to be very poor. Her weight was 8 lbs. 8 oz. (normal — 12 lbs.) ; her tongue was coated, the anterior fontanelle depressed and she was moderately dehydrated.

Nothing abnormal was discovered in the heart and lungs. Her throat was normal and the abdomen soft. The liver was two fingerbreadths below the costal margin ; the spleen was not palpable.

Subsequent history. From the time the child was admitted to the hospital, she continued to have 4-5 watery stools daily with blood and mucus. She was given sulphadiazine 0.5 gm. three times on the day of admission and all feeds were omitted for the first 12 hours. On the next day, oxytetracycline, 50 mg. three times a day was also given together with the sulphadiazine.

Intravenous fluids were given at the rate of 100 ml./lb. bodyweight on the first day of admission of which one-third was given as N/4 saline and 5 per cent. glucose, and the rest as 5 per cent. glucose. From the second day, this quantity was reduced to 50 ml./lb. and, after 3 days, to 25 ml./lb./bodyweight. Adequate " Eledon " feeds were given, so that the child obtained a full quota of fluid.

Two days after admission, fresh stools were reported as negative for amoebae, ova and cysts. The faeces were cultured for salmonellae, shigellae and the *E. histolytica* with negative results ; the latter was repeated three times in all.

On the second day of admission the serum electrolytes were estimated :

	2nd day	3rd day
Serum sodium	135 mEq/L	134 mEq/L
Serum potassium	3.9 ,,	4.2 ,,
Serum chlorides	90.5 ,,	106.0 ,,
Serum CO_2	22.0 ,,	22.0 ,,

The diarrhoea did not improve in spite of the oxytetracycline and sulphadiazine and, on the thirteenth day after admission, the patient had nine watery stools. In the early evening of that day, her abdomen became distended, and this increased gradually. By about 9 p.m. the distension was so pronounced that the child was found to be dyspnoeic. The drip was removed. Gastric suction was instituted and protigmin 0.25 ml. was injected subcutaneously. The child expired at about 3 a.m. on the 14th day after admission.

Post-mortem findings. Autopsy was carried out seven hours after death. Apart from hypostatic congestion of the lower lobes of the lungs, nothing abnormal was detected in the respiratory, cardiovascular or central nervous system. The gastro-intestinal tract was examined carefully and an appendicular abscess with a ruptured appendix in its midst was detected lying against the posterior abdominal wall. The abscess cavity measured ¼″ x ¼″. An amoeboma was seen on the postero-medial aspect of the middle third of the caecum (Fig. 1).

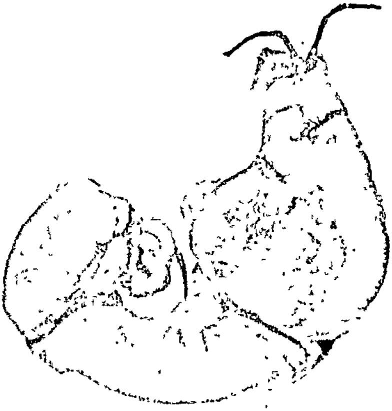

FIG. 1. Posterior view of caecum and appendix. The amoeboma has been cut longitudinally and the two halves opened out.

There was an enlarged lymph node (1″ x 1″) just anterior to the mass. The latter was cut into and a few ml. of yellow pus were seen. This was cultured and reported negative for bacteria.

Microscopic Findings : (Dr. (Mrs.) YOGANATHAN, Department of Pathology, University of Ceylon). The caecum and appendix show necrosis of intestinal mucosa, acute inflammation and the presence of several amoebae (*E. histolytica*). In the mesenteric gland, several phagocytes containing ingested particles were seen.

DISCUSSION

Amoebiasis is a common disease among adults in the tropics, but uncommon in children especially under one year. However DE SILVA (1949) reported amoebiasis in 15.9 per cent. of children under two years of age suffering from infantile diarrhoea in Colombo and its environs. SPECKNALL and PIERCE (1951) reported four cases with amoebic granuloma, all in adult seamen. WEISER (1952) reported a case of amoebiasis in a baby girl of 13 days. He saw the living vegetative forms of *E. histolytica* in the loose stools of this breast-fed infant. Her mother had amoebiasis. He did not discuss the outcome of the case. REPETTO (1953) has reported a case of a 46 hour old infant with amoebic dysentery proved on parasitological examination.

At the Children's Medical Centre, Harvard, of 2,070 cases of acute appendicitis in children under 16 years, only seven were found in those under one year of age. The youngest case was a child of six months of age. Our patient was only four months of age.

As far as our search of the literature went, the present case is unique in that an amoebic granuloma complicated by an acute appendicular abscess was found in an infant of four months of age who presented with an infectious type of diarrhoea with blood and mucus. Her stools were repeatedly reported as negative for *E. histolytica*, both on direct smear and culture. Autopsy revealed, however, that an acute appendicular abscess was present with an amoebic granuloma (amoeboma) of the caecum.

Prior to death the abdomen became grossly distended, but, as far as we are aware, she had neither pain nor restlessness which are the usual signs and symptoms of acute appendicitis in infancy.

Owing to the negative reports the child did not receive any amoebicidal drug, except for a 14 day course of oxytetracycline. As the autopsy revealed, this treatment has had no beneficial effect.

SUMMARY

A case of acute appendicular abscess complicating an amoebic granuloma of the caecum in an infant of four months is reported. This presented as an infectious diarrhoea with blood and mucus, but showed repeatedly negative faeces examinations for *E. histolytica* both on smear and culture.

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HEALTH SURVEY OF CHILDREN FROM RAROTONGA, COOK ISLANDS

(1) MEDICAL EXAMINATION AND EVALUATION

by

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From October, 1953 to June, 1954, the author made a growth and health survey of 165 Polynesian school children from the village of Titikaveka on the island of Rarotonga, Cook Islands, South Pacific

Medical examinations were given to 159 to 162 children, 5 to 16 years of age The examinations covered the following general topics eyes, ears, nose and throat , the body and its coverings , the internal organs , and, the sexual organs The results of these examinations are reported in this article

The second article in this series reports on the results of clinical tests given to the Rarotogan children Tests were made of their oral temperature, blood pressure, pulse and respiration rates, and reaction to tuberculin (Mantoux test)

The third article of this series is concerned with the skeletal age of this population X-rays of the right hand and wrist were made on 85 boys and 79 girls The skeletal age determinations were made following the atlas of GREULICH and PYLE (1950) In addition, observations were made on the presence or absence of skeletal anomalies

The fourth and final article in this series utilizes the Wetzel Grid technique of analyzing height and weight data This analysis yields information on the physique of the Rarotongan children and facilitates a comparison of their growth with that of American children

GEOGRAPHIC LOCALE

There are 15 islands in the Cook group, located between 9° to 23° South latitude and 159° to 167° West longitude They cover 100 square miles of land mass, spread over an ocean area of 850,000 square miles The islands are divided by distance and geography into a Northern and Southern group The 5 inhabited Northern islands are typical coral atolls with sparse vegetation and small populations Pukapuka is the best known representative of this group The 6 inhabited islands of the Southern group are volcanic in origin with fertile lowlands, mountainous interiors and are more populous than the Northern group Rarotonga, located at 160° West longitude and 21° South latitude, in the Southern group, is the largest island in the Cooks, with an area of 16,500 acres and a 20 mile perimeter It is the centre for the New Zealand administration which governs the Cook group

The total population of the Cook Islands was 15,343 in 1953, 97 per cent of whom are native Polynesians Over one-third of the Cook Island inhabitants live on Rarotonga In 1953, the population of Rarotonga was estimated at 5,671 native Polynesians and 417 Europeans The Cook Island natives have been racially mixed with European, Mongoloid, Negroid and other Polynesian populations for over 100 years The school children observed in this study reflect this mixture, since approximately 40 per cent of them are known to be descendants of Polynesian and non-Polynesian crosses

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* This study was made while the author and his wife, P C Fry, held Fulbright Fellowships under the administration of the United States Educational Foundation in New Zealand

METHODS AND MATERIALS

There were 85 boys and 80 girls aged 5 to 16 years in the basic group of school children. They include all of the children attending the government school in Titikaveka village. Due to illness and transfers to another school, some of these children were not examined in all ways.

The 159-162 Titikaveka school children were examined by the Assistant Medical Officer of the Cook Islands, Dr. ALEX LARSEN. My wife, P. C. FRY, assisted him and made the blood pressure, pulse rate, respiration rate, and temperature determinations.

MEDICAL EXAMINATION

The findings on the clinical features observed in the medical examinations of the Rarotongan children are summarized in tabular form in the appendix. Comments on certain of these features follow.

Eyes. Conjunctival injection was seen in 96 per cent of the Rarotongan children. Malnutrition is probably the major cause of conjunctival injection in this population, although a few cases may have resulted from salt water swimming. The condition is often associated with a lack of Vitamin A and riboflavin (COOPER, BARBER, MITCHELL and RYNBERGER, 1956). According to NICOL (1956), the high incidence of conjunctival injection seen in children from Nigeria is associated with a low riboflavin intake. The diets of most Rarotongan families are known to be deficient in riboflavin (P. C. FRY, 1957). Two-thirds of the families studied received less than 76 per cent of the amount recommended by the NATIONAL RESEARCH COUNCIL (1953). Further, one-third of the Rarotongan families received less than 75 per cent of the recommended amount of Vitamin A. It is reasonable to conclude that riboflavin deficiency and, to a lesser extent, Vitamin A deficiency have contributed to this high incidence of conjunctival injection.

Ears. Clinically significant amounts of ear wax were recorded for 74 per cent of the children. A medium amount was seen in most of these cases. The daily bath of the Rarotongans rarely involves the use of soap or washing the ears. These children show a slight trend to heavier deposits of ear wax with increasing age.

Throat. Seven percent of the Rarotongans had enlarged tonsils, and 4 per cent had inflamed tonsils, indicating that infection was present. However, none of them had undergone a tonsilectomy.

Hair. Notching or loss of the hair at the frontal bosses was seen in only 8 children. Frontal notching is considered by GREULICH, DAY, LACHMAN, WOLFE and SHUTTLEWORTH (1938) to be a sign of sexual maturation, and an end product of steriod hormone production. The 5 boys and 3 girls who did have frontal notches ranged in age from 9 to 16 years. Frontal notching is thus not as useful a sign of sexual maturation in this population as other measures, e.g., skeletal and dental age.

Axillary hair development also failed to show more than a slight age gradient. The criteria used in rating the presence or absence of axillary hair follow : *Stage* 1. Axillary hair present but scanty, was seen in 4 boys and 6 girls, or 6 per cent of the total production. These subjects ranged in age from 13 to 15 years ; *Stage* 2. Axillary hair present in moderate amounts appeared in one 16 year old girl ; *Stage* 3. Abundant, axillary hair was not observed on any of the Rarotongan subjects.

Pubic hair, however, did show a more definite age gradient The criteria by which the stage of pubic hair development was noted are as follows *Stage* 1 Pubic hair sparse, pigmented, straight or only slightly curled was found in 4 boys and 7 girls, or 7 per cent of the population, with ages ranging from 13 to 16 years , *Stage* 2 A moderate amount and spread of pigmented and curled pubic hair was seen in 4 per cent of the group, or 3 boys and 4 girls Their ages were in the range from 14 to 16 years , *Stage* 3 Pubic hair, widely spread, pigmented and tightly curled was found in one 15 year old boy

It appears that the appearance of pubic hair precedes that of axillary hair Thus, the Rarotongan data is in agreement with that reported by other observers (GREULICH 1941 , TANNER, 1955)

Skin The *incidence of skin diseases in the Rarotongans is low in comparison with* other Polynesian groups Table I compares the incidence of skin diseases in the Rarotongan children with Polynesians from Western Samoa (MARPLES and BACON, 1953), and a 1951 survey of children from Arorangi village on Rarotonga (FAINE and HERCUS, 1951)

The children from Titikaveka are equal to the children from Western Samoa only on the incidence of scabies The Samoans show a much higher incidence for the rest of the skin diseases For conjunctivitis, the incidence in Titikaveka is much higher than in Arorangi

Head lice were seen only in girls The Rarotongan girls rarely cut their hair, while the boys usually wear their hair short

TABLE I Rarotongan and Samoan skin diseases

Disease	Samoan % (aged 5 to 14)	Titikaveka % (aged 5 to 16)	Arorangi % (aged 6 to 20)
Scabies	21	22	10
Impetigo	42	0	0
Fungus infections	24	3	3
Yaws	45	6	—
Infected cuts and boils	12	6	—
Clear skin	11	41	—
Pediculosis capitis	—	7	11
Conjunctivitis	—	96	11

Dietary Deficiency Clinical evidence of dietary deficiency was seen in only 2 per cent of the children On the basis of subclinical indications, however, it was believed that many of the younger children were nutritionally deficient Two important indications of malnutrition are retarded skeletal ages, as reported in the third article in this series, and the high incidence of conjunctival injection These cases of malnutrition cannot be classified as kwashiorkor, since these children were not edematous, nor did they display such commonly present features as the typical hair and skin changes seen in this disease (TROWELL, DAVIES and DEAN, 1952 , WATERLOW, 1955)

All of the school children receive from 6 to 8 ounces of skim milk on school days This dietary supplement is made from dry skim milk powder, served during the morning recess periods The sanitary conditions under which it is prepared leave much to be desired, although the children do benefit from it in terms of increased calcium, riboflavin and animal protein intake P C FRY (1957) has indicated that calcium and riboflavin are the nutrients in which the Rarotongan diet is the most deficient These nutrients are particularly lacking in the home diets of children of school age. It seems reasonable to believe that their intake of skim milk has contributed substantially to the low incidence of clinically observable deficiencies.

Muscle Tone. Most of the subjects were rated as having only fair muscular tone. Two of them (1 per cent) had poor tone, and 5 (3 per cent) had good muscular tone. These results are surprising in view of the active life which these children lead.

These is reason to believe that the physician's scale of ratings was incorrect. In the table, the middle rating, *fair*, is undoubtedly the norm. It follows, then, that those few children with *good* muscle tone should be classed as having *excellent* muscle tone, whole those with only *fair* muscle tone have *good* muscle tone.

Skeletal System. All of the children had normal, upright posture. There were, however, 21 cases of genu valgum. These were evenly divided between the sexes, and were found in 11 girls and 10 boys over the age range from 5 to 16 years. Stage 4, four-finger insertion, was seen in 10 cases ; stage 3, three-finger insertion, was found in 7 children ; and stage 2, two-finger insertion could be seen in 4 cases. No cases of genu varum were seen.

Five cases of congenital skeletal defects were seen. All of these occurred in boys. They are listed in Table II.

TABLE II. Congenital defects of Rarotongan children.

Defect	Number of cases
Pigeon breasted	2
Accessory left auricle	1
Tibial exostosis	1
Bilateral Talipes equino	1

Internal Organs. Abnormal heart sounds were heard in 4 children. Systolic murmurs were heard in a 10 year old boy and an 8 year old girl, and a presystolic and middiastolic murmur was heard in a 12 year old girl. One 15 year old girl had a mitral stenosis. None of these children were handicapped by these defects, nor did they have any other symptoms. The examining physician did not believe that rheumatic fever was an aetiological factor in these defects.

Strong evidence of chest infections was seen in 10 individuals with an age range from 6 to 15 years. This infection was observed as rales or crepitations in one or both lungs, either at the apex or base. In most cases, tuberculosis was probably the cause.

Four of the Rarotongan subjects had enlarged livers. This condition may have resulted from a number of causes such as parasitic infections, tuberculosis and malnutrition.

Sexual Development. No boy under the age of 11 years had been circumcised. A listing of the age groups of the 17 boys who had been circumcised is shown in Table III.

Circumcision does not appear to be a strictly age-graded phenomenon on Rarotonga.

A listing of the 12 girls who had menstruated compared to the 8 girls in their age groups who had not menstruated is seen in Table IV. No girl under the age of 13 years had passed through the menarche.

TABLE III. Number of Rarotongan subjects circumcised

Age	Circumcised	Not circumcised	Total
11	1	4	5
12	5	1	6
13	1	9	10
14	4	7	11
15	3	4	7
16	3	1	4

TABLE IV. Age of Rorotongan menstruation

Age	Menstruated	Never menstruated	Total
13	2	6	8
14	6	2	8
15	4	0	4

The number of cases in this sample is far too small to enable the calculation of average menstrual age for the Rarotongans. However, this limited evidence indicates that menarche does not occur early in Rarotongan girls

Breast development was rated on a three-point scale, according to the following criteria : *Stage* 1. Infantile ; flat and small areola, no breast development *Stage* 2 Nipple and areola elevated ; breast enlarged , *Stage* 3 Nipple elevated , areola retracted and smooth with breast ; breast enlarged.

Table V shows the age and breast stage development of the Rarotongan girls

TABLE V. Breast development in Rarotongan Girls

Age	Stage 1	Stage 2	Stage 3	Total
10	10	0	0	10
11	4	2	0	6
12	4	2	0	6
13	3	5	0	8
14	1	8	0	9
15	0	3	0	3
Total	22	20	0	42

All boys were in Stage 1 of breast development. One boy had a slight case of nipple elevation, but no cases of gynecomastia were seen

Twenty girls had breasts in Stage 2 development, 12 of whom had been through menarche. No girl had been through menarche who did have Stage 2 breasts. REYNOLDS and WINES (1948) have shown that breast development in American girls precedes menarche by an average of 2.1 years. In their group, most girls were in the primary stage of breast development (Stage 2 of my scheme) at the time of menarche No age estimates either of the time of beginning breast development or of menarche can be made, but is is apparent that Rarotongan breast development does precede menarche.

Erect nipples were seen in 92 per cent of this population. The cause of this condition is not known, but it does not seem to be related to physical stimulii or to sex hormone production, since children of all ages showed the phenomenon.

Miscellaneous Clinical Observations. A tentative diagnosis of leukaemia was made for a 14 year old girl who displayed massive enlargment of the lymph glands in the submental, mandibular, deep cervical, and left axillary regions. A blood sample was taken, but the test proved inconclusive since complete testing was impossible with the limited laboratory facilities at the hospital.

One child with butterfly lupus, or large depigmented areas on both cheeks, was seen. This may have been either lupus erythematosus or lupus vulgaris.

SUMMARY

In general, the Titikaveka children are a healthy group, although they do have high incidences of various minor diseases.

Almost 96 per cent. of the Rarotongans suffered from conjunctival injection, which, in most cases, probably resulted from riboflavin and Vitamin A deficiencies.

A strict age-gradient could not be established for growth of axillary hair, but there is good evidence that, as in other populations, axillary hair formation precedes pubic hair formation.

Dietary deficiencies on the subclinical level were believed to be present for a number of these children. These deficiencies cannot be classified as kwashiorkor.

The available information prevents the calculation of the exact ages of occurrence of menarche and breast formation. It can be said, however, that breast formation precedes menarche in this group, as in other groups.

In a health survey of children from Western Samoa, MARPLES, commenting on the high incidence of skin infections, said:

" This preliminary survey can only serve as an indication, but the results suggest that child health in Samoa is far from satisfactory, and that the children are labouring under a fair amount of disability from skin conditions alone." (MARPLES, 1950, p. 239).

If the Rarotongan children as a group suffered from such disabilities, neither the examining physician nor the author noticed them.

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APPENDIX

Clinical features observed in Rarotongan children

			Total	
Clinical feature	Boys No.	Girls No.	No.	%
1. Eyes				
Poor vision	1	1	2	1
Strabismus	0	0	0	0
Conjunctival injection	82	73	155	96
Optic nerve lesion	0	0	0	0
Retinal abnormality	0	0	0	0
2. Ears				
Poor hearing	3	0	3	2
Wax	64	57	121	74
Sepsis	2	1	3	2
Foreign bodies	7	6	13	8
3. Nose				
Allergy	0	0	0	0
Septum deviation	0	0	0	0
Sepsis	3	0	3	2
4. Throat				
Abnormal tongue	0	0	0	0
Tonsils				
Small	67	61	128	80
Medium	7	8	15	10
Large	3	8	11	7
Congested	1	1	2	1
Inflamed	6	0	6	4
Sepsis				
Sore throat	3	1	4	2
Poor speech	1	1	2	1
5. Hair				
Head				
Clean	81	65	146	92
Septic	1	0	1	1
Pediculosis	0	12	12	8
Notching				
None	80	74	154	96
Slight	3	3	6	4
Advanced	1	0	1	1
Axilla				
None	78	66	144	89
Stage 1	4	6	10	6
Stage 2	0	1	1	1
Stage 3	0	0	0	0
Pubic				
None	76	65	141	88
Stage 1	4	7	11	7
Stage 2	3	4	7	4
Stage 3	1	0	1	1

Clinical feature	Boys No.	Girls No.	Total	
			No.	%
6. Skin				
Texture				
Fine	12	35	47	29
Medium	72	42	114	71
Coarse	0	0	0	0
Congenital defects	0	0	0	0
Nails				
Uncut	0	0	0	0
Cut	81	74	155	96
Bitten	3	2	5	3
Cut and bitten	0	1	1	1
Condition				
Poor	3	2	5	3
Fair	73	60	133	83
Good	8	15	23	14
Rashes				
Scabies	16	20	36	22
Acne	0	1	1	1
Ringworm	3	2	5	3
Eczema	1	0	1	1
Sepsis				
Boils	1	2	3	2
General	1	5	6	4
Folliculitis of upper lip	1	0	1	1
Lesions resembling yaws	8	1	9	6
Heavy bruises	0	0	0	0
Lacerations	0	0	0	0
Scars				
Minimal	39	62	101	63
Medium	37	11	48	30
Heavy	7	1	8	5
Striae	0	0	0	0
7. Subcutaneous fat				
Abnormal amounts	2	2	4	2
Abnormal distribution	1	0	1	1
8. Dietary deficiency	3	1	4	2
9. Abnormal lymph glands				
Axilla	11	4	15	9
Large	3	1	4	2
Small	1	1	2	1
Hard	1	2	3	2
Shotty	3	3	6	4
10. Muscle tone				
Poor	1	1	2	1
Fair	79	75	154	96
Good	4	1	5	3

Clinical feature	Boys No.	Girls No.	Total	
			No.	%
11. Skeletal system				
Posture				
Genu valgum				
Stage 1	0	0	0	0
Stage 2	1	3	4	2
Stage 3	4	3	7	4
Stage 4	5	5	10	6
Physique				
Android	84	0	84	100
Gynaecoid	0	77	77	100
Congenital defects	4	0	4	2
12. Heart abnormalities	1	3	4	2
13. Chest sounds	3	7	10	6
14. Abdomen				
Enlarged liver	3	1	4	2
Abnormal spleen	0	0	0	0
Abnormal kidneys	0	0	0	0
Palpable masses	0	0	0	0
Hernia	0	0	0	0
15. Genitalia				
Boys				
Testes				
Abnormal descent	0	—	0	0
Small average	1	—	1	1
Average	83	—	83	99
Circumcised	17	—	17	20
Girls				
Menstruated	—	12	12	16
Breasts				
Stage 1	84	61	145	90
Stage 2	0	20	20	10
Stage 3	0	0	0	0
Erect nipples	75	73	148	92
Inverted nipples	7	9	16	6

MATERNAL AND CHILD HEALTH SERVICES IN SOUTH-EAST ASIA

(IX) NEPAL

by

P. ROBINSON

(*W.H.O. Adviser in Maternal and Child Health, Regional Office for South-East Asia, New Delhi.*)

Nepal, as Afghanistan (ROBINSON, 1956, c), is not actually situated in South-East Asia, but is served by the South-East Asia Regional Office of the World Health Organization.

There are only a few hospitals in the country, the largest being the Government " Bir Hospital " in Kathmandu, with a bed strength of 150. The number of doctors in Nepal, with an estimated population of 8 millions, is only about 60. All of them, with the exception of the foreign missionaries, had received their training in India. About half are fully qualified doctors, the other half being " licentiates " (ROBINSON, 1956, a).

There are no trainee nurses or midwives in the country. However, a nursing school has been opened about three years ago, and the first batch of 20 students completed their nursing course in Kathmandu and are now undergoing midwifery training in India.

As in India, the Ayurvedic School of Medicine is recognized as equal to " global medicine " (ROBINSON, 1956, a).

In order to provide staff for planned rural health services, Health Assistants, similar to those in Burma (ROBINSON, 1956, b), are being trained at present in two schools, but not with identical curricula.

MATERNAL SERVICES AND MATERNAL PROBLEMS

Practically all deliveries are conducted by indigenous *dais*. As far as is known those are mainly hereditary birth attendants, as in India. Occasional deliveries are conducted in mission hospitals, and there are six maternity beds in the female part of the Bir Hospital in Kathmandu. Those beds are almost invariably occupied by women in whom complications occurred during delivery and who were rushed to the hospital as emergency cases.

There is no evidence that any women in the country has hitherto had the benefit of any ante-natal or post-natal care or advice. The three major health hazards of women in childbearing age appear to be syphilis, " oedema " and anaemia.

The laboratory of the Bir Hospital, the only one in existence in the country, finds negative blood serology in only about one-third of any unselected patients. Those women, who are referred by the female part of the hospital, appear to be invariably positive. Clinical signs of primary or secondary syphilis are seldom reported, but a condition described as " syphilitic paraplegia," which is said to respond to anti-syphilitic treatment is common.

The nature of the " oedema " is not known. The urine shows no pathological findings. It resembles a condition previously described in India as " epidemic dropsy."

Anaemia is sometimes reported to be extremely severe. Haemoglobin values of 10 per cent are said to be no rarity and 5 per cent has also been found.

SERVICES FOR CHILDREN AND PROBLEMS OF CHILDHOOD

There are three children's wards in the country — all in Kathmandu. Ten beds are reserved for children of the Mission Hospital, but there is no paediatrician. There are seven beds for children in the female part of the Bir Hospital and six in the male. A paediatrician, trained in London, is in charge. He also runs an outpatients clinic daily. The paediatrician performs all the operations on child patients.

Children accompanied by the mother or another female attendant are admitted to the female part of the hospital ; those with a male attendant or without any attendant, to the male section. The female part which is used as a training field for student nurses provides a far superior service to the male section. The mothers are permitted to sleep with their children (adult beds are provided) and deceive their food from the Hospital.

No special personnel are employed in the children's wards. In the female part of the hospital, student nurses help in the care of the children, while the mothers feed them as a rule. In the male part, where there are only " in-service trained " male attendants, the children receive very little care.

The majority of the child patients are hospitalized for surgical conditions. Unlike neighbouring countries, gravely ill or moribund children are not seen in the wards. This is partly due, no doubt, to the deep-rooted desire of the family to have their child die at home. Moribund adult patients are also, as a rule, removed from the hospital by their relatives.

Little or nothing is known about the incidence of morbid conditions in childhood. Malnutrition appears to be less common than in neighbouring countries. The only explanation that can be offered at this stage is prolonged breast-feeding, sometimes up to four years. Children not seldom continue to be breast-fed when they already participate at the family meal. One sees an occasional case of xerophthalmia and, more frequently, skin conditions resembling pellagra.

No infant or child has ever had the benefit of preventive care, except for smallpox vaccination.

FUTURE PLANS

A new building has been erected, as a result of a contribution by the king, which will house the first Maternal and Child Health Centre in the country. Financial assistance and additional personnel is being provided by the Government of India. A Board of Management consisting of representatives of a voluntary welfare association, the Ministry of Health and His Majesty has been constituted.

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BOOK REVIEWS

Textbook of Pediatrics. (Seventh Edition). Edited by Waldo E. Nelson. 1959. Philadelphia and London : W. B. Saunders Company Ltd. pp. 1462. £5-15-6d.

It is a pleasure to receive the latest edition of what is undoubtedly *the* pediatric reference book for the world at large and to note that its previous excellence is maintained while its contents have been brought as up-to-date as possible. Thus, the greater menace of resistant staphylococci in the newborn, the more newly recognized biochemical diseases (such as " Maple syrup urine disease ") and the unfolding story of the Enteroviruses and the ARBOR group all testify to the modern coverage included.

As far as the tropical pediatrician is concerned, this large book is an imperative need as a source-book, although the orientation is often not exactly appropriate to the different ecological circumstances of the tropics.

Certain sections are devoted to entirely tropical problems, including Helminthic and Arthropod diseases by Faust, Malaria by A. J. Walker, Kala-azar in children by Achar and Tropical eosinoplilia by Beaver.

It is perhaps not necessary to review this book at all, but merely to draw attention to the fact that a new edition is out. This in itself should suffice, as the latest version of Nelson is by now a basic piece of equipment to all pediatricians.

Blood Groups. 1959. British Medical Bulletin Vol. : 15. No. 2. pp. 84. £1.

Antibiotics in Medicine. 1959. British Medical Bulletin Vol. : 16. No. 1. pp. 84. £1.

These two recent editions of the British Medical Bulletin are of interest to the tropical pediatrician. In the volume on Blood Groups, edited by A. E. Mourant, the sections on haemolytic disease of the newborn are particularly valuable, while the chapter on blood groups and anthropology is of great interest.

The publication on Antibiotics is the best comprehensive account of present-day knowledge of this vast field. The early chapters deal with the theoretical bases, including chemistry, mechanisms of drug resistance, principles of therapeutic use and its laboratory control. The latter part of the publication is more directly clinical and covers combined therapy, preventive use of antibiotics in medicine and surgery, the chemotherapy of tuberculosis, and dangers of antibiotics, including drug resistance. The final chapter points to the road ahead when discussing the search for new antibiotics. In all it is a " focal " publication and can be recommended both for its contents and as a clarifier of a confused scene.

Thai Children Under Four. By T. D. Stahlie. 1959. Amsterdam : Scheltema and Holkema. pp. 269. 16/-.

This interesting booklet is based on the author's two years' experience in Thailand as WHO adviser in Maternal and Child Health.

The presentation is logical commencing with a brief account of the people and the country and the main public health problems, followed by a description of some of the more important fields used in MCH training activities, vital statistics and results of personally supervised surveys carried out by the author.

The over-all aim of the two years project was to attempt to evaluate and assess the present status of maternal child health services in the country, and to plan for future developments. The book is replete with information concerning young Thai children, but, in addition, it is perhaps of more general interest in that it shows some of the ways in which this type of evaluation of MCH services can be attempted.

Neo-Natal Paediatrics. Edited by W. R. F. Collis. 1958. London : William Heinemann Medical Books Ltd. pp. 301. 30/-.

This is a lively and useful publication by numerous Irish paediatricians headed by Dr. Collis. The coverage is wide, including anaesthesia in the new-born, the management of the baby of the diabetic mother and plastic surgery in infancy.

It is essentially practical in its orientation and avoids discussion of the overly rare and obscure. It is in fact a modestly priced and extremely useful account of the more important aspects of physiology and disease in the neo-natal period. The methods suggested in therapy are for the most part in general use, although occasionally some less usual procedure (i.e. the rocking device in the premature incubator) may reflect stimulating views held by the Rotunda Hospital group of paediatricians.

NUMBER TWO March, 1960

African Child Health

*This Section of the Journal is devoted entirely to papers
dealing with the health and welfare of the
African Child*

PYLORIC STENOSIS*

(A case report of a female African infant in Uganda)

by

O P ARYA, M B AND E C B HALL CRAGGS M A , M B

(Uganda Medical Service)

Only two case reports of pyloric stenosis in infants (LUDER, 1956, HAMILTON, 1957) have so far been published in East Africa This fact would suggest that there is an unusually low incidence of this condition It is thought that unless all proved cases are reported this impression can neither be confirmed nor refuted For this reason a further case is presented showing some unusual features

CASE REPORT

On 11/6/59, Matama, a female Musoga, aged four months, was admitted to Jinja Civil Hospital Her mother said that she had been vomiting after her feeds since birth and that she had appeared to have had abdominal pain over this period She had been passing stools daily The mother had had three other children The last, now aged seven, was the only survivor None of these had shown symptoms of vomiting in infancy

On examination, the child was found to be dehydrated Her skin was inelastic and the fontanelles depressed The pulse was 130 per min and the temperature 100 F There were no abnormalities found in the heart or lungs The abdomen showed visible peristalsis in the epigastrium, progressing from left to right No tumour was felt

The weight on admission was 9 lbs 3 ozs Soon after admission a subcutaneous infusion was set up A provisional diagnosis of pyloric stenosis was made and medical treatment instituted The child appeared to improve for a few days although the staff nurse reported that most feeds were followed by a small vomit However, on 16/6/59, the weight had fallen to 8 lbs 6½ ozs At this time the visible peristalsis was more marked and a tumour was palpable It was decided to perform a laparotomy, and under local anaesthesia a Ramstedt operation was carried out

Graduated post-operative feeds of 5 per cent glucose proceeding to expressed breast milk allowed normal breast feeding to be resumed after 48 hours The patient was discharged from hospital on 29/6/59 when her weight was 10 lbs 8½ ozs The child was seen again on 6/7/59 and 20/7/59 There had been no vomiting or other complaint The child was still gaining weight

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* We are indebted to the Director of Medical Services, Uganda, for permission to publish this report

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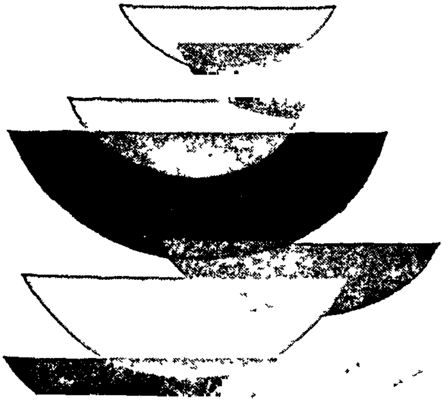

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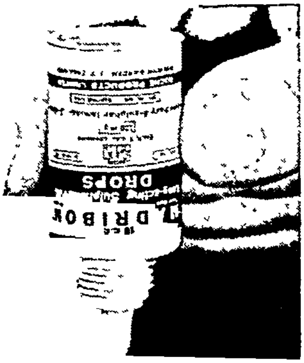

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THE SERUM LIPIDS IN KWASHIORKOR

II THE RELATION OF DIET TO TOTAL SERUM CHOLESTEROL

by

C E MATTHEW, B A AND R F A DEAN, M R C P, PH D

(Medical Research Council Infantile Malnutrition Research Unit, Mulago Hospital, Kampala, Uganda)

It is well established that in the child who is acutely affected by kwashiorkor, the total serum cholesterol is at a low level, and that during successful treatment there is a rise that is due almost entirely to an increase in the esterified fraction, the free fraction remaining almost unchanged A summary of the literature is given in the previous paper (SCHWARTZ and DEAN, 1957) which also indicates the pattern often followed by the cholesterol values — a rise from the low value, succeeded by a fall A similar pattern was found by SCHENDEL and HANSEN (1958) who thought that variations of the pattern could be correlated with progress judged clinically

During the last few years, we have from time to time estimated total cholesterol as part of the routine of biochemical investigation intended to provide means for the assessment of the value of different therapeutic diets, and we have made two observations that seemed to be of interest the first, that the pattern just mentioned, although it is common, cannot always be distinguished, and the second, that alterations in the diet, and especially in the kind of fat in the diet, seem to be reflected by the cholesterol We have reviewed our accumulated data to see if they support these impressions It should perhaps be emphasized that, for the most part, the data were not obtained in experiments made for the purpose of producing changes in serum cholesterol levels In consequence, there were simultaneous variables that would have been avoided in set experiments, and that have complicated analysis

A large literature has been produced on the effects of diet on the serum cholesterol of adult man, and there seems to be little doubt that high values are usual if the diet contains much saturated fat, and that unsaturated fats tend to lower the values (BRONTE-STEWART, 1958) Butter, and cottonseed oil and peanut oil may be taken as representatives of the two classes of fats, and the results to be presented show their effects on children who we were treating for kwashiorkor No similar studies on healthy children have been made, so far as we know

THE CHILDREN AND THEIR TREATMENT, AND THE METHODS OF ANALYSIS

The children were admitted to the wards of the Infantile Malnutrition Unit for the treatment of kwashiorkor They varied considerably in the degree to which they were affected, but all showed enough of the signs for unequivocal diagnosis (TROWELL, DAVIES and DEAN, 1954)

In the comparison of various diets, some children have been given one diet at first, and afterwards another, and other children have been given one of the diets throughout treatment. For the present purpose, only the records of children in the latter category have been used, and a further limitation has been imposed by accepting only those records in which the total cholesterol on admission was less than 140 mg./100 ml. serum. A choice was necessary because it was not possible to interpret confidently the meaning of changes from high values.

The records of 142 children, aged between 10 and 36 months, survived the discards. The children were bled on admission and at intervals afterwards. About half were bled more or less regularly over a period of three weeks, and their results only were used for the study of the different patterns made by the cholesterol values. Ideally, they should have been bled on the 7th, 14th and 21st days : as that was not always practicable, the values of those days were obtained where necessary by interpolation from the values on the actual days of bleeding. It was found that there was close agreement between the averages obtained by this method and those obtained by using the results of analyses done on sera taken on the 7th, 14th and 21st days.

The diets used were these : the descriptive titles are used later :

(a) *Fat-free* — Protein derived from " Casilan " (the Glaxo brand of calcium caseinate) and dried skimmed milk.

(b) *Butter* — Protein as in (a) : butter added.

(c) *Cottonseed oil* — Protein as in (a) : cottonseed oil added.

(d) *Biscuit* — One-eighth of the protein derived from dried skimmed milk, three-quarters from groundnuts, and one-eighth from a cereal mixture in which maize predominated : fat derived from the groundnuts and from cottonseed oil.

The blood was taken and the sera preserved as explained in the first paper, and the total cholesterol was estimated by the methods of ZLATKIS, ZAK and BOYLE (1953) or of ZAK, DICKENMAN, WAITE, BURNETT and CHERNEY (1954). The methods were tested on the same sera, and gave results that did not differ by more than 3 per cent.

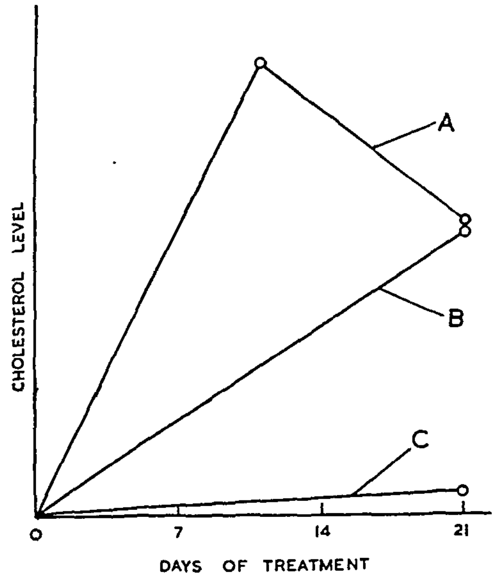


FIG. 1. Diagram to show the patterns given by cholesterol values during treatment.

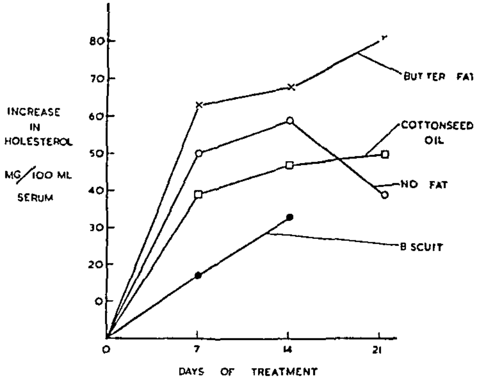
Results

(a) *The patterns of the cholesterol values* The 3 patterns that could be distinguished in the results of the series of 69 children regularly bled are shown in Fig 1 The " peak " pattern (A) was shown by about half of the total number of cases most of the rest showed the gradual rise (pattern B), and a few a very small rise or none at all (pattern C)

In this series, the severity of the condition on admission, as judged clinically or by other biochemical criteria, was not clearly related to the subsequent appearance of a particular pattern early, moderate or severe cases all showed an approximately equal number of pattern A and pattern B Of the 3 cases showing pattern C, one was a severe case of kwashiorkor and two were of the marasmic type

Pattern A and pattern B were also shared equally by children who in the recovery phase gained weight well (over 100g /day) or moderately well (20 to 100g /day) There were 5 children who gained less than 20g daily 1 showed pattern A, 3 pattern B and 1 pattern C

FIG 2 The average increases in serum cholesterol caused by different diets The point for the biscuit diet on the 21st day has been omitted because the number of observations was only 6



Some positive findings emerged when the effects of diet were considered The diet that was most constantly associated with pattern A was the fat-free milk diet, and the least successful in producing this pattern was the biscuit diet The total numbers of children having either diet were small, but 11 of the 14 who had the fat-free diet, and only 1 of the 6 who had the biscuit diet, showed the pattern

(b) *The increase in cholesterol values caused by different diets* All the available data on the 142 children were used The average figures for the 7th, 14th and 21st days are given in Table I, and the increases from the starting levels are represented graphically in Fig 2 The chief points of interest seem to be

(a) The high values produced by the butter diet, which were significantly different from those produced by the cottonseed oil diet on all three days,
(b) the fall on the 21st day, completing a typical peak pattern for the fat-free diet,
(c) the low values on the 7th and 14th days produced by the milk diet containing cottonseed oil, and
(d) the very low value produced by the biscuit diet on the 7th day

TABLE I. The increase in cholesterol values caused by different diets.

Diet	Fat intake (g./kg.body weight/day	Protein intake (g./kg. body weight/day	Number of estimations	Day of treatment	Cholesterol (mg./100 ml. serum)	S.D.
Fat-free	0	5.3	19	1	105	25.3
			20	7	155	39.3
			18	14	164	42.7
			14	21	144	30.3
Butter	5.3	7.3	28	1	96	17.0
			32	7	159	44.9
			31	14	164	41.1
			16	21	177	44.9
Cottonseed oil	5.8	5.2	56	1	96	21.1
			63	7	135	35.6
			48	14	143	38.9
			33	21	146	35.2
Biscuit	6.0	4.2	28	1	106	15.9
			28	7	123	16.4
			13	14	139	29.5
			6	21	157	36.8

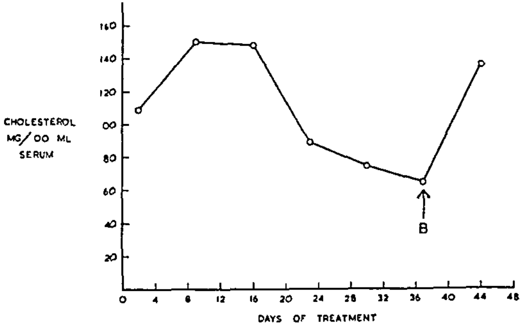
The value at 7 days for the cottonseed oil diet was significantly different from the values at 7 days for both the butter and the biscuit diet. The values at 14 and 21 days for the cottonseed oil diet were significantly different from those at 14 and 21 days for the butter diet. For all these comparisons, P was less than 0.05.

DISCUSSION

In the previous paper it was suggested that the early increase and later fall of the lipid components of the serum during the treatment of kwashiorkor might be due in part to phanerosis : to the unlocking of lipid held in the liver in abnormal amounts until the therapeutic diets brought about the formation of the lipid-protein complexes needed for lipid transport. The recent work of ARROYAVE, BEHAR, WILSON, MENDEZ and SCRIMSHAW (1959) supports the suggestion : they found that the increased quantities of lipids and of Vitamin A that appeared in the serum could be related to the decreased quantities in liver tissue obtained at the same time, by biopsy. It seems reasonable to suppose, therefore, that values for serum cholesterol on the 7th and 14th days of treatment depend on the extent of the phanerosis : the values found later might also depend on the same process to some degree, but it could be expected that the excess fat would be removed from the blood as metabolism became more normal. The peak pattern (A in Fig. 1) would be produced, but the height of the peak and the rate of decline, might be governed by several factors which include the quantity of fat locked in the liver tissue and the efficiency of the diet.

A second mechanism must now be considered. The successful treatment of kwashiorkor brings about a brisk renewal of all kinds of synthetic activity, and it is fairly certain that new cholesterol is formed at a rapid rate. The formation would presumably be represented by a steady increase in the amounts found in the serum, giving a rising pattern like that called B in Fig. 1. The line would not continue to rise indefinitely, but would undoubtedly become curved, and finally horizontal, as the " normal " level was reached : with the results shown in Fig. 2 in mind, the " normal level " was somewhat arbitrarily fixed at 140 mg /100 ml serum The " normal " level would not be the same for all individuals — the range in healthy children is probably as wide as 75 to 150 mg /100 ml serum — and, if experienced with adults was a guide, it would be influenced by the kind of fat in the diet butter would give a high level, and vegetable oil a low one, and the effect might depend on the quantity as well as the kind of fat

FIG 3 The changes in the serum cholesterol of one child during treatment Butter fat was substituted for vegetable oil at the point B and caused a considerable increase



It was obvious that the simplest way of finding out whether the kind of fat was important was to give both kinds to the same child, and Fig 3 shows the results of an experiment in which that was done The serum cholesterol rose and fell, and then remained at a low level until butter was given, when it rose by 71 mg in 7 days As the other children had been given diets in which the ingredients varied, it was possible to test the effect of different amounts of fat by grouping the results according to the consumption daily *per* kg body weight For cottonseed oil, the difference between average intakes of 4 5 g /day/kg and 6 6 g /day/kg was clear the higher intake gave lower values on each of the three days For butter, there was a surprising tendency for higher intakes to give lower values, but the number of cases was not sufficient for a satisfactory statistical confirmation of the tendency In passing, it should be noticed here that whatever else these figures show, they must indicate the absence of any effect due to preformed cholesterol in the diets The amounts of this cholesterol were probably negligible

The children who had no fat at all showed increases in cholesterol on the 7th and 14th days almost identical with those of the children given the diets containing small amounts (averaging 4 5 g /day/kg) of cottonseed oil The dietary constituent of the fat-free diet that was chiefly responsible was probably the protein, and it was obviously desirable to attempt to decide the extent of its influence Unfortunately, however, the low fat intakes were associated with high protein intakes, and the high fat intakes with low protein intakes, and the effects of the two dietary constituents could not be separated

The chief results that have been obtained can be tentatively interpreted as follows

(a) a diet rich in protein, but containing no fat, will cause the rapid removal of the cholesterol abnormally retained in the liver, but is not especially favourable to the synthesis of new cholesterol

(b) A diet containing butter as well as large amounts of protein will not only liberate the retained cholesterol, but will actively promote synthesis

(c) A similar diet, but with cottonseed oil instead of butter, is probably effective in liberating the retained cholesterol but does not favour rapid cholesterol synthesis, and may even depress the synthesis.

(d) The biscuit diet is relatively ineffective in liberating the retained cholesterol, and is slow to start new synthesis.

Some further information is available about the biscuit diet. It has recently been compared with a milk diet in the treatment of kwashiorkor, and found less efficient in causing loss of oedema and the regain of weight, and in protein and enzyme synthesis (DEAN, to be published). One reason may be that in the cooking of the ingredients, some of the essential amino acids become unavailable : an improved method of preparation, which gives less opportunity for such damage, has been much more successful in most respects, and it will be interesting to see whether or not the new product causes rapid changes in the serum cholesterol.

Our results suggest that it is unwise at present to place too much reliance on the values for total cholesterol found in the serum in the early part of treatment. A rise and fall (giving the pattern called A in Fig. 1) may indicate a favourable response to the therapeutic diet, but the later values will depend on the kind and amount of fat in the diet, and possibly on the amount of protein and the state of the amino acids.

The results obtained by SCHENDEL and HANSEN (*op. cit.*) who were using diets that were not primarily chosen for their therapeutic efficiency, should perhaps be regarded as valid only for the special conditions of their experiments. A fall to a low level, that they thought to be of grave prognostic value, was not associated, in our cases, with a deterioration in clinical condition.

Protein as a source of cholesterol is in danger of being overlooked nowadays in favour of fat, which has more spectacular effects. There is little doubt, however, that cholesterol can be formed even if the diet contains no fat, probably in part from acetate that has its origin in amino acids (DEAN and SCHWARTZ, 1953) and it might be that dietary protein determines a " basic " level of serum cholesterol, that is varied by the superimposed effects of fat, and probably of other dietary constituents.

SUMMARY

Diets containing no fat, butter fat and vegetable oils were compared in their ability to alter the low levels of serum cholesterol found in kwashiorkor at the start of treatment. The fat-free diet, exerting its effect through its protein, caused a rapid rise and fall of the cholesterol values. The " peak " pattern so produced was also found when butter and cottonseed oil were given. The " peak " probably represented the release of cholesterol from the liver, where it had been imprisoned with excessive amounts of other lipids. In agreement with work done recently on adults, butter gave high values, and cottonseed oil low ones. A biscuit diet, which contained peanut and cottonseed oil, failed to release rapidly the imprisoned cholesterol. The failure was probably due to alterations in the availability of amino acids that reduced the efficiency of the biscuit protein. Dietary protein may determine a " basic " level of serum cholesterol, on which the effects of fat are superimposed.

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EDITORIAL

VILLAGE LEVEL INFANT FEEDING IN TROPICAL REGIONS

The scientific basis for the feeding of young children is the same all over the world, although methods of application will have to vary to suit the local circumstances

Initially, it has to be realised that, although there may in fact be a large number of different ethnic, religious, dietetic and socio-economic groups within a country, all with their own special problems, there are, for practical purposes, often two main groups in the tropics as far as infant feeding is concerned, although, of course, many will fall between these two extremes

The first are the usually small well-to-do minority who (i) have a house with an adequate kitchen with running water, a store of some kind, and occasionally refrigeration facilities, (ii) earn sufficient money to be able to buy such often high-priced infant foods as milk for their offspring in adequate quantities, and (iii) among whom, mothers have received enough formal education so that they can understand and carry into practice ideas concerning quantities, dilutions and the need for cleanliness Methods of infant feeding for this group can, with minor modifications, follow standard practices employed in Europe and North America

The second group, the vast majority, inhabit rural regions, either in villages or scattered homesteads, or have flocked to the " septic fringes " of urban slums, or, if more fortunate, to low-rent housing estates It is this group who have little or no education, a small earning capacity, and dirty fly-ridden kitchens with no storage facilities and few cooking utensils This is the group among whom malnutrition is common and who require attention with regard to practical and practicable advice on infant feeding In many regions, a further *subdivision may be made of great nutritional importance within the group*—*into* those with land and those without

The most appropriate and suitable plan for locally realistic infant feeding for the majority must take into account certain factors in the local ecology, as methods suggested and health education employed to persuade families to change their feeding habits must be within this framework.

At least seven groups of local factors will require consideration : (i) the pattern of infant feeding, with especial relation to the length of breast feeding, methods of weaning, use of animal and vegetable protein foods ; (ii) the panorama of malnutrition in early childhood, whether other conditions such as rickets, infantile scurvy and beriberi occur as well as protein-calorie syndromes ; (iii) incidence of common diseases in children likely to play a part as conditioning factors, such as infective diarrhoea, hookworm disease and tuberculosis ; (iv) available foods, including their costs, seasonal availability, whether bought or grown ; (v) the culture pattern with especial relation to local food ideologies, as, for example, whether certain foods are considered to be bad or good for children, or cause or make worse various diseases, (vi) simple home economics, in regard to the type of kitchen and fuel, the number of meals daily, local measures of weight and volume known to the mother ; (vii) the status and activities of women, including the customary duties and how they may influence the mother's opportunity to feed her child or leave him with a sibling for long periods, and also the actual status of women, as they will affect the amount of money that they may receive from their husbands for household expenses, including the purchase of expensive protein foods for their infants.

All in all, it is readily apparent that it is the first duty of those planning infant feeding to make themselves really aware of these local factors. Certainly if this were always done, more policies of infant feeding would be practical and realistic than is at present the case.

THE INTERRELATIONSHIP OF DIET AND INFECTION IN THE PRODUCTION OF EXPERIMENTAL HEPATIC FIBROSIS

by

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Summation of sub-threshold stimuli is a well-known physiological phenomenon. Similarly sub-threshold insults to tissues can summate and result in altered function. The interrelationships of malnutrition and infections were extensively discussed at the Third Inter-African Nutrition Conference in 1956, and in kwashiorkor or protein malnutrition it is well-known that gastro-enteritis can cause a flare-up of the malnourished state and there have been observations to suggest that intestinal flora may in fact prevent or allow the malnutritional state to develop (Macdougall, 1957, 1958; Smythe, 1958). One aspect of this interplay of malnutrition and infection was suggested by Walters and Waterlow (1954) in their description of the increased hepatic fibrosis in children in the Gambia. This increased fibrosis, the authors postulated, was due to the dual insults to the liver itself of chronic malaria and of malnutrition.

In experimental rabbits on an imbalanced diet which resulted in increased hepatic fibrosis, it was shown that, in the absence of chronic liver infection, not only did the animals survive twice as long on the diet but the pattern of the fibrotic response was altered (Macdonald, 1958a). In order to simulate more closely conditions such as those experienced by the Gambian children it was decided to infect mice with malaria and to feed these animals on the diet which had been shown to give rise to hepatic fibrosis in rabbits.

METHODS

Adult albino mice were divided into groups and each group was given one of the following: —

(A) Experimental diet and malaria
(B) Normal diet and malaria
(C) Experimental diet and malaria and chloroquine
(D) Normal diet and malaria and chloroquine
(E) Experimental diet and chloroquine
(F) Normal diet and chloroquine
(G) Experimental diet
(H) Normal diet (controls)

The number of animals in each group was originally 10, but on one occasion the animal room became overheated and many mice died, so to three groups, A, C and D, another 10 animals were added.

The experimental diet has been described (Macdonald and Thomas, 1956) and consisted of 35.5 per cent calcium caseinate, 57.5 per cent sucrose, 2 per cent dried yeast, 5 per cent salts with added vitamins A and D and was fed ad libitum in tablet form.

The malarial infection was with *Plasmodium berghei* given intra peritoneally. The chloroquine was given intramuscularly in 0.1 mg. doses when the parasitaemia reached 5 per cent. (This method of maintaining malaria was very kindly suggested by Dr. G. J. Bruce-Chwatt.)

Parasite counts were done approximately every ten days on each animal with malaria and reinfection or chloroquine given as necessary. Reinfection was necessary in those animals on the experimental diet which contained milk protein (Maegraith, Deegan and Jones, 1952) or where the chloroquine had suppressed the malaria completely. The animals continued under treatment until they died.

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*I am grateful to the Medical Research Council for a grant towards expenses and to Dr. L. G. Goodwin of Burroughs, Wellcome & Co., for supplying me with *Plasmodium berghei*. I also wish to thank Mr. R. W. Earl for valuable technical assistance.

TABLE I. The values for collagen in dry, fat-free liver, the proportion of liver lipid, the mean survival time and number of animals in each test group.

	Collagen in dry, fat-free liver g/100g. Mean	S.E. of mean	Mean liver lipid g/100g.	Mean survival time (days)	Number of animals
Experimental diet and malaria	4.5	± 0.93	12.1	55	14
Normal diet and malaria	2.5	± 0.45	14.4	14	10
Experimental diet and malaria + chloroquine	3.6	± 0.57	16.4	138	17
Normal diet and malaria + chloroquine	3.4	± 0.72	8.1	300	13
Experimental diet and chloroquine	2.1	± 0.56	16.4	183	5
Normal diet and chloroquine	2.7	± 0.24	15.7	—	7
Experimental diet	3.1	± 0.36	18.2	164	6
Normal diet	2.0	± 0.20	12.9	—	10

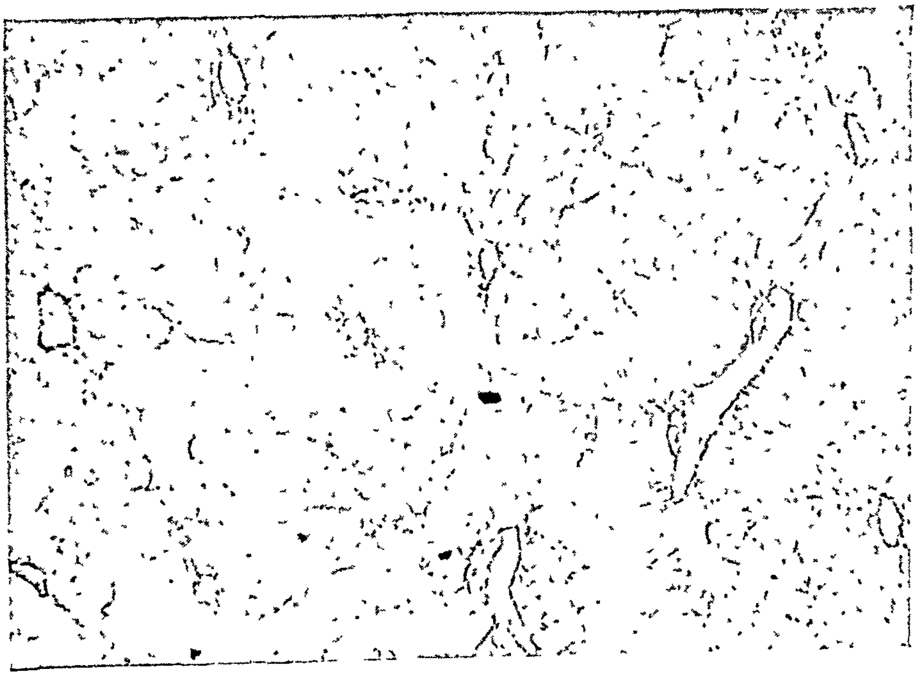

FIG. 1. Reticulin in liver of animal on control diet. (x 80).

On the death of each animal the liver was removed and weighed A portion was taken for histological examination and the remainder dried in a vacuum desiccator When dry the fat content was estimated by extraction with petroleum ether (BP 40 60°C) in a Soxhlet and the collagen in the dry fat-free liver was estimated by the method of WARREN and WAHI (1947)

The histological sections were stained with haematoxylin and eosin and, to show the reticulin, by GOMORI's method (1937)

RESULTS

The mean percentage of collagen in dry, fat-free liver, lipid in dry liver, the average survival time and number of animals in each group are shown in Table I

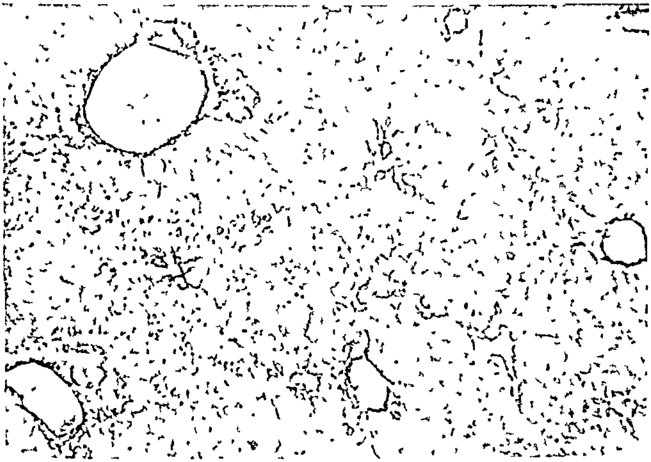

FIG 2 Reticulin in liver of animal on normal diet and with malaria for 11 days (x 80)

To learn whether the mean collagen values were significantly different from control the collagen percentages were subjected to an analysis of variance (FISHER, 1937) From the p values obtained by this method the following conclusions may be drawn

1. (1) There is a tendency for the experimental diet to increase the hepatic collagen (p = 0 1—0 05)
2. (2) There is also a tendency for the malaria to increase the hepatic collagen (p = 0 1—0 05)
3. (3) Malaria in animals on the experimental diet is associated with an increased proportion of collagen in the liver (p = 0 05—0 025)
4. (4) There is a slight tendency for the liver collagen to increase in the animals with chloroquine and malaria (p = 0 1—0 05) but not in those mice on chloroquine without malaria (p = 0 4) confirming the chloroquine does not increase the liver collagen

The mean survival time was shorter in those groups which were fed the experimental diet compared with those where the diet was normal except in the group with normal diet and malaria. The shorter survival time in this group was no doubt due to the protection against *Plasmodium berghei* given by the casein in the experimental diet.

Histological sections showed (Figs. 1, 2 and 3) an increase in reticulin particularly in the midzone of the liver lobule in those animals with malaria on a normal diet, whereas with malaria and the experimental diet not only was the midzone increase in reticulin more marked but fine threads could be seen spreading out from the portal triads and there was also increased thickening around the central vein.

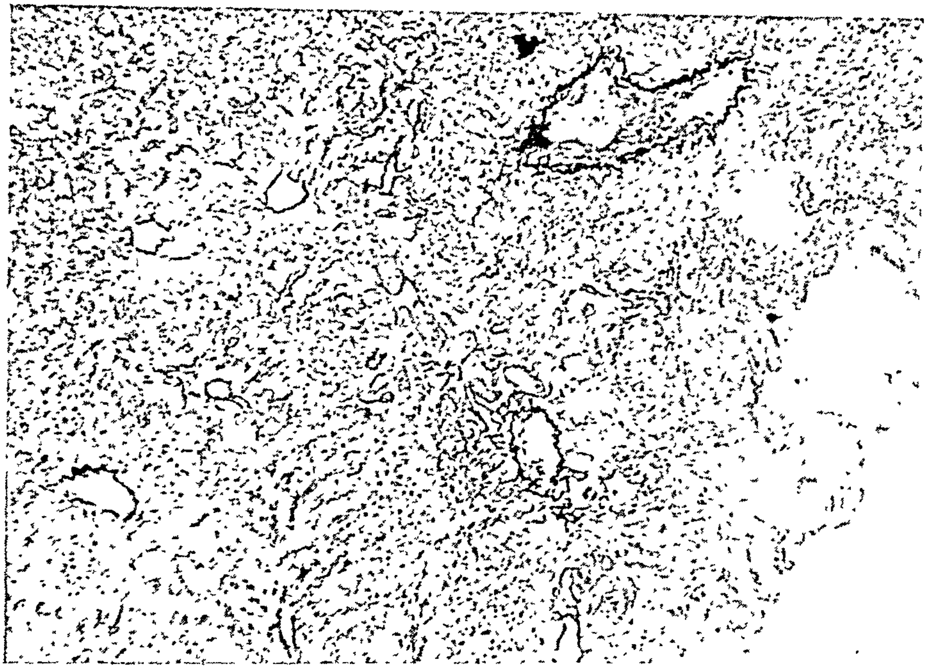

FIG. 3. Reticulin in liver of animal on experimental diet and with malaria for 22 days. (x 80)

DISCUSSION

The increase in liver collagen found in the mice infected with malaria and fed on the experimental diet would support the hypothesis of WALTERS and WATERLOW that malaria and malnutrition together are responsible for the increased hepatic fibrosis seen in children in the Gambia. In these experiments either insult applied alone showed only a tendency to an increase in hepatic collagen whereas the two insults applied together resulted in a greater liver fibrosis. Furthermore this increased fibrosis took place during the average time of 55 days, whereas the mice on the experimental diet alone and whose hepatic fibrosis was less marked survived three times as long, and those animals with " chronic " malaria and a normal diet survived nearly six times as long. Not only is there increased hepatic collagen on the experimental diet with malaria but this increase occurs much more rapidly.

Some evidence in children to support the view that malaria and/or schistosomiasis give rise to increased collagen in the liver has been found in a study of the hepatic lipid in Bantu children (MACDONALD, to be published) Some of the liver specimens came from an area comparatively free of malaria and schistosomiasis (Johannesburg), while the remainder were from a region where these infections were plentiful (Lourenço Marques) Comparison between the collagen content of the livers obtained from each region showed that those from the region with infection had a significantly higher proportion of collagen ($p = 0.05$) The number of cases of malnutrition were not sufficient to draw any conclusions about the effect of malnutrition, with and without infection, on liver collagen content

The question naturally arises as to whether the combination of malaria and malnutrition, found only too frequently in tropical regions, leaves permanent hepatic scars in those who survive If the increased collagen in the liver were to persist from early childhood then cirrhosis of the liver might be expected to occur much earlier in life in these malnourished malarious individuals than it actually does A possible explanation why this is not so may lie in the fact that collagen in the liver is not the permanent structure that had been imagined, but it may be that it can be removed In fact there is experimental evidence supporting this view (MACDONALD, to be published) and it is suggested from this work that under certain circumstances collagen can be removed from the liver If this were so, then the increased hepatic collagen in malnourished and/or malarious children may not necessarily be permanent Some supporting evidence for the postulate of hepatic collagen removal is seen in the proportion of collagen in the group of mice on experimental diet, malaria and chloroquine These animals were exposed to the two insults for over twice as long as the experimental diet and malaria only group and yet this increased exposure did not result in twice as much collagen In fact it was less (though not significantly) and one possible explanation for this could be that collagen was being removed from the liver at a rate slightly less than its laying down

This " fluid-state " concept of hepatic collagen has been accepted with regards to hepatic fat and emphasised recently (GILLMAN and GILBERT, 1958) The tendency has been to consider only an increase in hepatic lipid in disease, that the liver can become fatty and not that it can become " lean " There is evidence in European adults that the liver can become " lean " as a result of disease (MACDONALD, 1958b) and, in the series of animals presented in this paper, there is experimental support for the findings in man As seen in Table I the proportion of mean liver lipid is lower in those mice on normal diet, malaria and chloroquine than in controls This reduction in liver lipid in statistically significant ($p = 0.02—0.01$) and it seems that the livers in this group have become " lean "

The experimental diet was chosen not because it was intended to imitate in any way the diet consumed by children with kwashiorkor, but because it had previously been found to result in hepatic changes and fibrosis in rabbits and mice (MACDONALD, 1958b) The factors associated with the diet which give rise to this particular hepatic response are not known, but are being investigated

SUMMARY

In mice an experimental diet together with malaria gives rise to increased hepatic collagen which is not only greater in extent than with either insult alone but is more rapid in development The possibilities of collagen removal and of a " lean " liver are discussed

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NOTICES

FIFTH INTERNATIONAL POLIOMYELITIS CONFERENCE

This Conference, sponsored by the International Poliomyelitis Congress and the Danish National Association for Infantile Paralysis, will be held in Copenhagen, July 26-28, 1960.

The Conference will be held with two subjects : Part I Virology, and Part II Poliovirus Vaccines. A detailed programme has been established by a Scientific Programme Committee chaired by Dr. Frank L. Horsfall, Jr., M.D. Personal invitations to present scientific papers have been issued through the International Poliomyelitis Congress by the Scientific Programme. Committee Time will be allowed for general discussion of these papers.

Enquiries should be addressed to the Secretariat, 5 Tuborgvej, Helerup, Denmark.

FIRST INTERNATIONAL MEDICAL CONFERENCE ON CONGENITAL MALFORMATIONS

This Congress on Congenital Malformations is to be held in London from July 18th-22nd, 1960.

Sessions will be held on Incidence, Intrinsic Factors, Extrinsic Influences, General and Abnormal Developmental Mechanisms, Maternal-Foetal Interactions, Physiological and Medical Problems and, finally, Perspections.

Enquiries should be directed to the Secretariat, 67 New Bond Street, London, W.1.

CLINICAL STUDIES ON SOUTH TRINIDADIAN CHILDREN

II THE TREATMENT OF NEONATAL TETANUS

by

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Most textbooks give the impression that neonatal tetanus is almost universally fatal and this gloomy view appears to be supported by reports from many parts of Africa and America of few or isolated cases of survival (JELLIFFE, 1950 , DIETRICH, 1951 , FRIEDLANDER, 1951 , SPIVEY, et al , 1953 , GELFAND, 1955 , KLENERMAN and SCRAGG, 1955 , SARROUY, et al , 1956 , THIOUDET et al , 1956 , PINHEIRO, 1957 , TOMPKINS, 1958 , ADAMS, 1958) It is the object of the present communication to emphasise that recovery need not be uncommon, even with simple methods of treatment, so long as skilled nursing care is provided

CASE MATERIAL

Between August 1955 and November 1958, twenty infants suffering from neonatal tetanus were admitted to the General Hospital, San Fernando, and of these twelve (60 per cent) recovered In each case the baby had been delivered at home, usually by a handywoman, known locally as a " middy " though on three occasions the labour and puerperium had been managed by a trained nurse, while one mother had delivered herself The cord had been cut with scissors or a safety razor blade and it was said that the only application to the umbilicus had been some type of proprietary baby powder It was not possible to examine any of the powders bacteriologically, but in most cases the grimy rags used as cord dressings and binders suggested that such an investigation would be superfluous

In this context, it is surprising that, while throughout Trinidad neonatal tetanus is closely associated with unskilled midwifery, its incidence is lower in the half of the island with the higher proportion of deliveries by untrained attendants This discrepancy may be associated with a local variation in the number of handywomen who are in the habit of cauterizing the cut end of the umbilical cord in the flame of an oil lamp

The age at the onset of symptoms appeared to bear the usual relation to the outcome, the mean incubation period being 8 5 days in the survivors, compared with 7 4 days in the fatal cases, or 6 9 days after the exclusion of one child dying from gastroenteritis at the age of seven weeks, by which time mild rigidity was all that remained of his tetanus

The infant was usually brought to hospital because it had stopped sucking , occasionally generalized spasms or cyanosis had been noticed, but it was remarkable that the rigidity which was invariably present had rarely caused alarm

In a community in which neonatal infection is common, it is surprising that stiffness in a baby is not widely recognised as being of grave significance Experience of other conditions suggests, however, that disorders which are present at birth or which have an insidious onset tend to be neglected, while sudden dramatic episodes or failure to feed are more likely to cause the mother to seek advice

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*I am grateful to the Director of Medical Services for permission to publish and to Sister CAESAR BAIRD and the nursing staff of the General Hospital San Fernando who are largely responsible for the survivors in this series

On examination, all the cases showed moderate or marked rigidity of the limbs, trunk and abdominal wall, and frequently the infant had assumed a characteristic pugilistic attitude (Fig. 1). There was always trismus, and attempts at examination of the fauces would often precipitate a generalized spasm. The umbilical cord had usually separated, leaving an umbilicus that was moist and, in one or two cases, frankly septic.

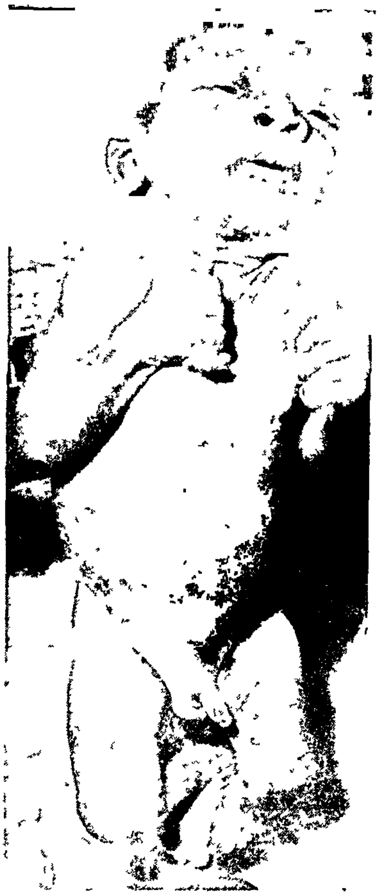

FIG. I

TREATMENT

The infants were treated along conventional lines with four main objectives :—

(1) Neutralization of toxin was attempted by the use of a single intramuscular dose of 100,000 international units of tetanus antitoxin, preceded by hyaluronidase (1 mgm.) at the injection site ;

(2) Sedation was established with either phenobarbitone (12-24 mgm.) or chlorpromazine (5 to 6.3 mgm.) the latter drug apparently having a more marked effect, especially in the control of trismus. In five of the later cases in this series, chlorpromazine was supplemented by promethazine (5 mgm.).

The drugs were given at intervals of four to eight hours by intramuscular injection, insulin or tuberculin syringes being used to ensure accurate dosage. As improvement occurred, oral administration was substituted because of induration and, occasionally, abscess formation at the injection sites. Frequent, prolonged or severe spasms were usually controlled by supplementing the basal sedation with intramuscular injections of sterilized paraldehyde (0.5 ml.) but in one child minor episodes persisted until the addition of diphenylhydantoinate (16 mgm.).

(3) Nutrition was maintained in the earlier cases of the series by intermittent tube feeding, but it was found that passage of the catheter, even under heavy sedation, often provoked such crises that patient spoon or pipette feeding was safer.

In many cases the best method seemed to change with the child's condition from day to day and the choice was generally left to the nurses. Arrangements were made for the mothers to express their milk and breast feeding was restored as soon as the infant was able to suck.

(4) Anti-bacterial therapy began in the earlier cases with crystalline penicillin or erythromycin, but in the last seven children crystallin penicillin and streptomycin were used. In infants with persistence of fever or pulmonary complications, a change was made to another of the drugs mentioned, or to a tetracycline, chloramphenicol or a sul-

phonamide, alone or in combination Aspiration of the pharynx with an electric suction apparatus occasionally appeared life-saving, but the need for this and for oxygen administration decreased when less emphasis was placed on supplying the theoretical needs of food and fluid

Fever was present at some stage in every case and six infants registered axillary temperatures (°F) of 104 6, 105 6, 106 2, 107, 107 4, 107 6, then went on to recovery When the temperature gave rise to anxiety the child was sponged with alcohol and nursed nude in the draught from an electric fan or an open door At first from force of circumstances and later from choice, all these children were nursed in an ordinary open children's ward

RESULTS

Of the twenty infants admitted with neonatal tetanus, twelve recovered and were *left with nothing more than a residual stiffness which was not interfering with their feeding* Of the fatal cases, three died within a day, (9,19 and 21 hours) of admission and were found at autopsy to have widespread pulmonary consolidation, while one, in whom minor *twitching had been unusually persistent, had a torn tentorium and a subdural haemorrhage* in the posterior cranial fossa Another who weighed 4 lbs 10 oz (2 1 Kg) on admission

TABLE I Certain clinical details of 8 fatal cases of neonatal tetanus

Series No	Age (days)			Antibiotic or Chemotherapy	Sedation	Remarks
	Onset	Admission	Death			
(1)	5	6	7	P	Phen	P M Pulmonary collapse
(6)	11	12	49	P Ch Ph	Chlor	Death from gastroenteritis after recovery from tetanus P M wasting only
(8)	7	8	12	P	*Chlor* *Am*	*Prolonged twitching P M subdural harmorrhage*
(10)	6	7	7	E	Chlor	P M Haemorrhagic pneumonia
(12)	9	12	31	E	Chlor	Unexpected death after apparent recovery P M Pulmonary collapse
(13)	8	10	11	P	Chlor	P M Lobar pneumonia
(15)	7	7	8	P S	Chlor	P M *Haemorr hagic pneumonia*
(20)	6	7	27	P S	*Chlor* *Prom*	P M Collapsed left lung

had responded rapidly and had stopped treatment for eight days when he developed gastroenteritis which led to his death seventeen days later.

Autopsy showed only pulmonary collapse in the other three cases, one of whom had improved to the point where treatment had stopped and discharge was contemplated when he died quite unexpectedly. This phenomenon of late, unaccountable death has been seen here in both children and adults and appears to bear no relationship to tetanic spasms or to attempts at their control (Table I).

COMMENT

Tetanus neonatorum is a recognised hazard of delivery under unhygenic conditions and is, therefore, usually found in areas where it is difficult to provide adequate medical or nursing care ; it may be for this reason that so many reports emphasize the rarity of recovery. In Trinidad, tetanus is not a notifiable disease and its incidence and fatality rate are therefore unknown. However, during the period of this investigation, the disease was seen on forty-seven occasions in older children and adults, twenty-one (45 per cent) of whom died, suggesting that the condition is as dangerous here as it is elsewhere. It may be that because neonatal tetanus in Trinidad is more often the result of accidental contamination than of deliberate soiling of the umbilicus with traditional dressing materials, massive infection is less common, but this hypothesis is not supported by evidence of a long incubation and a mild course.

The diagnosis is rarely difficult and even if the significance of the rigidity is not appreciated any attempt to examine the throat will disclose the characteristic trismus.

No special virtue is claimed for the management outlined here and no attempt has been made to evaluate the different drugs used, since the object of this study was simply the development of a regime adapted to local facilities (Table II). Antitoxin was given intramuscularly for safety and simplicity but was preceded by hyaluronidase in the hope that this might accelerate its absorption. In the absence of convincing evidence that interference was beneficial, the umbilicus was neither injected nor exercised.

Chlorpromazine has been administered in comparatively few of the reported cases of neonatal tetanus and its use in a daily dose of 100 to 150 mgm. has been disappointing (ADAMS, 1958) but since its adoption here in a much smaller dosage, trismus has no longer given rise to serious difficulty in feeding, while the control of spasms has seemed smoother. It should be emphasised that no attempt was made to eliminate the muscular rigidity which appeared less harmful than the heavy sedation necessary to produce relaxation, while reflex spasms have been decreased rather than abolished by the drugs in the dosage used here.

Early in the series, an attempt was made to keep up the infant's oral intake to the estimated needs for food and fluid, but this led to alarming episodes of regurgitation and cyanosis which became uncommon when a less obsessional attitude was adopted. It often seemed that rigidity of the abdominal wall in our patients prevented the abdominal distension seen after a feed in the normal infant and so limited the volume which could be accommodated. Severe dehydration was not seen in these underfed infants, but intermittent subcutaneous infusions of 4.3 per cent dextrose and 0.18 per cent saline were given to one or two infants in whom there was considerable weight loss.

At first, antibiotics were given for their expected effect on the tetanus bacillus and in the hope that they would decrease pulmonary complications of the disease. However,

TABLE II Certain clinical details of 12 surviving cases of neonatal tetanus

Series No	Age (days) Onset	Admission	Discharge	Antibiotic or Chemotherapy	Sedation	Remarks
(1)	10	11	43	P,P S } Tet P Su }	Phen	Max T 106 2
(3)	10	13	38	P E P S }	Phen	Max T 104
(4)	7	9	22	P	Chlor	,, 99
(5)	12	13	37	E P	Chlor	,, 100 4
(7)	8	8	40	P P S } Tet, Ch	Chlor	,, 107 4
(9)	10	12	45	P	Chlor	101 8
(11)	7	7	51	P, E Ox Ch	Chlor Phen Ep }	,, 103 8
(14)	9	10	23	P S }	Chlor	,, 101 4
(16)	8	9	46	P S } P Ph } Ch	Chlor Prom }	,, 104 6 Intercurrent gastroenteritis
(17)	10	13	34	P S } Ph	Chlor Prom	,, 105 6 Intercurrent gastroenteritis
(18)	6	7	48	P S } Tet, Ch	Chlor Prom Phen }	,, 107 6
(19)	7	8	42	P S } Tet	Chlor Prom }	,, 107

P	— Penicillin	S	— Streptomycin	Tet	— Tetracycline
Ox	— Oxytetracycline	Ch	— Chloromphenicol	Su	— Sulphadimidine
Ph	— Phthalylsulphathiazole	E	— Erythromycin	Chlor	— Chlorpromazine
Phen	— Phenobarbitone	Am	— Amylobarbitone	Ep	— Diphenylhydantoinate

the finding of widespread pneumonia in infants dying soon after the onset of symptoms of tetanus suggested that more vigorous antibacterial treatment was called for An umbilicus contaminated with tetanus bacilli is likely to have been the portal of entry for the commoner organisms causing neonatal sepsis, so that a single narrow-spectrum antibiotic is no longer thought adequate

For administrative reasons, the earlier cases in this series had to be nursed in an open children's ward It soon became obvious that light and noise were less likely to provoke spasms in neonates than in older children and adults and it was found that most of these babies showed little response to any but tactile stimuli Since an open ward allows a numerically inadequate staff to maintain close supervision, no attempt is now made to isolate cases of neonatal tetanus

Experience elsewhere of a similar regime under overcrowded and unsatisfactory conditions has left little doubt that the most important single factor in the survival of these children was the combination of patient, careful feeding with the maximum of observation and the minimum of handling. It is to be hoped that improved nursing standards will soon provide this in areas in which tetanus neonatorum has not yet been abolished.

Neonatal tetanus has been prevented by active immunization during pregnancy (PARISH, 1958) and this might be a way of decreasing the incidence of the disease in Trinidad, where 73 per cent of mothers attend antenatal clinics, yet 40 per cent of deliveries are carried out by handywomen. Many of the mothers prefer to call in a " middy " for the labour and puerperium even when her fee is higher than that of the subsidized trained nurse who has supervised the pregnancy. This inconsistency appears often to be due to the fact that the trained nurse limits her activities to the care of the mother and child and asks for the provision of a layette and other materials that the mother cannot afford or thinks unnecessary, while the handywoman looks after the home and the entire family and is prepared to make do with whatever equipment she is given.

Fortunately the untrained attendant is chosen usually for economic rather than social reasons and there is little traditional resistance to her replacement. However, the fact that three of these cases were delivered by professional nurses suggests that in Trinidad ignorance is not the sole cause of neonatal tetanus, so that training schemes to raise the standards of handywomen are unlikely to abolish the disease.

SUMMARY

Twenty babies with neonatal tetanus were seen in a general hospital in a period of forty months. Conventional treatment and careful nursing permitted the recovery of twelve infants, while tetanus was the sole cause of death in only three of the fatal cases.

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THE ROLE OF TETANUS NEONATORUM IN INFANT MORTALITY IN THAILAND

by

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In a recent editorial in *The Journal of Tropical Pediatrics*, dedicated to the prevention of tetanus neonatorum, it was stated that there is " a considerable need to obtain a clearer statistical view as to how much of a public health problem it (i e this disease) is in different regions "

As a result of sample surveys conducted in Thailand in 1957 and 1958, it seems possible to give for this country at least a provisional answer to the challenge quoted above

The Kingdom of Thailand, a country the size of France with a population of 22,586,588 (May, 1956), was officially reported as having a birth rate of 34 9 per 1000 inhabitants in 1955, and an infant mortality of 56 1 per 1000 live born for the same year Though, due to some under-reporting of births and deaths, the real incidences of both may be somewhat higher, especially the babies dying in the first few days of life tending to escape notification, (STAHLIE, 1959), the writer feels justified in assuming that the real infant mortality in the year 1955 was not higher than 70 per 1000 live born Thus, infant mortality in Thailand, although still very high in comparison with more developed countries, is among the lowest in Southeast Asia

The causes of infant deaths, however, are extremely difficult to unravel, since it rarely happens that an infant who has died is examined by a qualified physician The " causes of death " as officially reported are concocted by the district health officer (who is not a physician, but usually a sanitarian) from the often scant and inaccurate data supplied to him by the village headman who, in his turn, has to rely upon what the head of the family told him Moreover, tetanus neonatorum as such is as yet not a notifiable disease in Thailand, so that deaths from this disease tend to become officially thrown together with others under such headings as " certain symptoms referable to nervous system and special senses " and " ill-defined diseases peculiar to early infancy "

Though Thailand is in the process of developing a maternal and child health service of high standing (METTROP and ROBINSON, 1957), certainly not more than fifteen per cent of the women in childbirth are assisted by skilled birth attendants at present The rest are delivered by " granny " midwives, so-called *mohtamyae*, who, as a rule, do not even suspect that there exists a connection between unhygienic ways of handling the umbilical stump and neonatal tetanus Therefore it seemed reasonable to assume that neonatal tetanus makes a fair contribution to infant mortality in Thailand In a country where such is the case one would expect to notice, after the usual gradual decrease in infant mortality from the first day on, a sudden increase around the eighth day of life, after which the gradual decrease would resume its course

From the official Thai statistics concerning infant mortality no conclusion could be drawn in this respect, since they are reported for each day separately during the first week only and from then onwards for the whole second, third and fourth week respectively Now the mean daily number of infant deaths in the second week in 1955 was lower than the lowest figure reported for any day of the first week, which might either mean that neonatal tetanus is a relatively unimportant cause of death or that its influence is neutralized by a very low number of deaths from other causes during the second week

The Journal of Tropical Pediatrics, June, 1960

In the course of an investigation made into the problems connected with health and disease of young Thai children (STAHLIE, 1959), we questioned samples of, in total, 1,755 mothers from seven different parts of the country (six from typically rural areas and one from Bangkok, the capital) concerning the 2,349 pregnancies they had had during the four years preceding the interrogation. These pregnancies had resulted in the birth of 2,364 children (15 pairs of twins), of which 20 (8.5 per 1000) had been still-born. Of the 2,344 children who were born alive, 94 had died by the time the mothers were interrogated ; 79 of these had died in the course of their first year, an infant mortality of 33.6 per 1000 live-born. Since about 30 per cent. of the babies had not finished their first year at the time of investigation and since it is to be expected that some of these were destined to die before completing their first year (thereby adding an unknown fraction to the 33.6 per 1000 mentioned) the latter figure has to be corrected. From the course of infant mortality in the group born from one to four years prior to the moment of investigation, it was calculated that the corrected figure was not likely to be higher than 35 per 1000. That the figure found by us, *viz.* 35 per 1000 live-born, over the period 1953-1957, is considerably lower than the officially reported infant death-rate of 56.1 per 1000 for 1955, is presumably due to the following factors :

(i) all areas investigated by us had been made practically free from malaria and from yaws.
(ii) all areas investigated had a fair road connection with well-equipped and well-staffed hospitals, so that deaths from conditions such as pneumonia and dysentery were relatively uncommon.

This assumption is consistent with the fact that, although mortality between 1 and 12 months for the whole country was reported as 39.0 per 1000 as contrasted with 17.9 per 1000 for our samples, neonatal mortality for the whole country in 1955 (17.1 per 1000) was of the same order of magnitude as that found by us (15.8 per 1000). The differ-

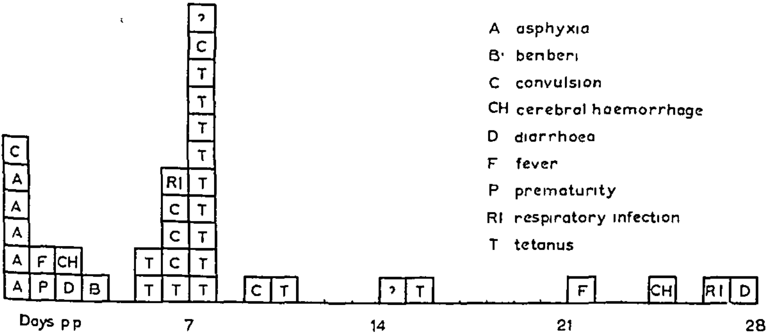
TABLE I. Mortality in the Neonatal Period.

Group	1	2	3	4	5	6	7	Total	Per 1000 live-born
No. of children in sample	452	511	244	265	190	187	495	23,44	
Died first day :	3	—	—	2	—	—	1	6	2.6
Died 2nd day :	—	—	—	1	—	—	1	2	0.9
Died 3rd day :	—	1	—	—	1	—	—	2	0.9
Died 4th day :	1	—	—	—	—	—	—	1	0.4
Died 5th day :	—	—	—	—	—	—	—	—	0.0
Died 6th day :	—	—	2	—	—	—	—	2	0.9
Died 7th day :	2	1	1	—	1	—	—	5	2.1
Died 8th day :	—	1	1	5	3	—	1	11	4.7
Died 10th day :	—	1	—	—	—	—	—	1	0.4
Died 11th day :	—	—	1	—	—	—	—	1	0.4
Died 15th day :	—	—	—	—	1	—	—	1	0.4
Died 16th day :	—	1	—	—	—	—	—	1	0.4
Died 4th week	1	1	—	—	—	—	2	4	1.8
Neonatal deaths :	7	6	5	8	6	—	5	37	15.8

1—Northern Thailand ; 2—Northeastern Thailand ; 3—East Central Thailand ; 4—West Central Thailand ; 5—Northern part of Peninsular Thailand ; 6—Southern part of Peninsular Thailand ; 7—Bangkok City. 1 to 6 refer to typically *rural* areas.

ence encountered is, in other words, a difference in infant mortality after the first month of life, that is in the period in which the factors mentioned stand a good chance of being much more influential than in the first month.

In Table I a subdivision of deaths in the neonatal period according to age at death has been made. From this Table it is at once apparent that, after a gradual decrease during the first 5 days, a sharp rise occurs, culminating in a peak on the eighth day. It is also clear that this peak is caused by a number of deaths in some of the rural areas only, the sample from Bangkok city merely contributing one death between the third and the twenty-second day of life. This by itself would make a strong argument in favour of tetanus neonatorum causing the sudden sharp increase in neonatal deaths around the beginning of the second week. This argument was, in fact, supported by the description of the symptoms preceding the deaths that the mothers gave us. Usually it is hardly possible to diagnose the cause of death exactly from the symptoms described, but in cases of neonatal tetanus such a classical description is often supplied by the mothers that the diagnosis seems beyond doubt.



GRAPH I

In Graph I the cause of death or at least the main symptoms preceding death are pictured for the neonatal period. Where tetanus is mentioned the classical syndrome was described, but there clearly is also an increase in number of deaths from " convulsions," which may or may not have been caused by tetanus. That several were caused by tetanus seems probable, since all children dying from " convulsions " on the seventh or eighth day had been well during the first few days of life, according to their mothers. Thus it is shown that in our samples 14 out of 37 neonatal deaths (38 per cent.) were certainly caused by tetanus, and 5 more (13 per cent.) were possibly due to the same cause. The important role played by tetanus as a cause of neonatal deaths seems well established by our figures.

It has been mentioned that more than 85 per cent. of the women in confinement were assisted by unskilled birth attendants. In 1957 the Division of Maternal and Child Welfare made a start with giving simple training courses for these *mohtamyae*. The training course consists of two weeks of instruction in elementary obstetric technique with the emphasis on cleanliness and avoidance of infections. The course is given by a senior nurse, the provincial nurse supervisor.

Groups of 25 *mohtamyae* from a certain district are selected to attend the course, which receives financial assistance from UNICEF. This assistance consists of a stipend for the trainees, amounting to approximately U.S. $7.50 (originally $5.0) and the issue of a simple midwifery kit on completion of the course. An important item in this kit is a number of sterile cord dressings supplied by the MCW Division. The kits are handed to the *mohtamyae* in a small ceremony led by the local village abbot and the *mohtamyae* make a solemn promise to report regularly to the midwife in the nearest health centre the number of deliveries assisted by them and to hand in their kits for inspection and refill. By the middle of 1958, this scheme was already in operation in 30 of the 71 provinces, and the results have been promising thus far. The *mohtamyae* have been grateful for the opportunity offered and have reported fairly regularly. One of the first indications of the effectiveness of this training scheme should be a decrease in deaths from tetanus neonatorum. Therefore it is to be hoped that this disease will become notifiable before long, because it forms an excellent and easy-to-use yardstick to measure the efficiency of an important aspect of the MCH services.

SUMMARY

The role played by neonatal tetanus as a cause of neonatal mortality in Thailand is discussed. In the course of sample surveys concerned with the outcome of 2,349 pregnancies during the period 1953—1957 inclusive, it was found that 37 of the 2,344 children born alive had died in the neonatal period. Of the latter 14 (38 per cent.) appeared to have died from tetanus with certainty, and 5 more (13 per cent.) had had suggestive symptoms. The role of tetanus as the leading cause of death in the neonatal period seems thereby well established. Extension of the recently inaugurated training courses for unskilled birth attendants, so-called *mohtamyae* will, in the author's opinion, lead to a sharp decrease in deaths from tetanus neonatorum. Therefore it would seem advisable to incorporate tetanus into the national list of notifiable diseases.

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NOTICE

CONFERENCE ON INFECTIOUS DISEASES OF THE PRE-SCHOOL CHILD

To be held in Lagos 25th, 26th and 27th January, 1961

Interested organizations are invited to send medically qualified representatives and to notify the Administrative Secretary, West African Council for Medical Research, Yaba, Lagos, of their names and addresses as soon as possible and certainly not later than the 30th June.

There will be no Conference Fee but the Council regrets that it is unable to meet travelling and hotel expenses.

OSTEOMYELITIS DUE TO PENICILLIN-RESISTANT STAPHYLOCOCCI IN INFANCY FOLLOWING SUPPURATIVE MASTITIS

(REPORT OF A CASE)

IS'HAQ K. MICHAEL M D AND FRED H HOWARD, M D *

(From the Dhahran Health Centre Dhahran, Saudi Arabia)

Several reports of haematogenous osteitis of the newborn have been published lately (DENNISON, 1955 , BOYES, et al , 1957 , WOLMAN, 1956), and the danger of the penicillin resistant *Staphylococcus aureus* to the newborn cited (GELLIS, 1958) We have recently encountered a case of osteitis of the right humerus following suppurative mastitis of the left breast in an infant who demonstrated the pseudoparalysis emphasized by BOYES et al (1957) It would appear that the dangers of penicillin resistant staphylococci are found not only in metropolitan areas with their large nurseries, but also in small desert communities Because it appears that this disease may be more frequently encountered in the future in all tropical regions, we would like to call attention to it with this case report

CASE REPORT

M M , a 24 day old white female infant, was brought to the clinic because of a lump on the left breast Following a normal delivery, and a birth weight of 8 pounds 7½ ounces, she had an uneventful five day period in our hospital nursery with exception of some regurgitation of formula and a mild transient erythematous rash A routine newborn check-up was conducted on her 15th day and a mild papular rash of the abdomen was reported No treatment was deemed necessary for this At the age of 24 days she was brought to the clinic because of left breast swelling It was apparent that she had a left suppurative mastitis The breast was incised and drained of about 10 cc frank pus, a rubber drain was inserted, and a specimen sent for culture and sensitivity She was given procaine penicillin 300,000 units daily for three days The day following the incision the mother noticed that the baby seemed in pain when she moved her right arm Nothing was found to account for this on examination The following day the baby refused to move the arm A moderate swelling of the right shoulder was noted, plus some tenderness in the area The differential diagnosis was between a metastatic abscess with pseudoparalysis of the right shoulder and a traumatic injury On the third day post incision and drainage, an X-ray was taken of the shoulder, but no abnormality was seen The radiologist reported " There is slight irregularity of the medial aspect of the upper humeral shaft adjacent to the epiphyseal line This is not sufficiently marked to be, in itself, considered of any significance " The following day the breast abscess appeared to be nearly healed, but the patient's rectal temperature was 100 6°F , and the right shoulder was now more swollen, warm, very tender and with a persistence of the right pseudo paralysis A metastatic abscess was diagnosed The white blood count was 28,350 per c mm with 39 per cent polymorphonuclears The infant was admitted and the abscess opened, over 10 c c pus being found Digital examination of the abscess cavity revealed involvement of bone and it was then clear that we were dealing with an osteitis A Penrose drain was left in the wound, dressing applied, and the arm was immobilized by fixing it to the side of the chest with an Ace bandage over a thick padding Following surgery the baby was given chloromycetin and erythromycin by mouth Chloromycetin was given for three weeks (150 mgms every six hours for five days , then 64 mgms every six hours for 15 days) Erythromycetin was given in doses of 100 mgms every six hours for five weeks

From the pus was recovered a coagulase positive staphylococcus aureus, the same as was reported from the breast abscess The organism was resistant to both penicillin and streptomycin, but sensitive to chloromycetin, tetracycline, aureomycin, erythromycin and terramycin. Following surgery her rectal temperature ranged from 99.0 to 100.8°F. for three days, remaining normal thereafter. On the second post-operative day a clamp was introduced into the wound and more pus evacuated. The following day the drain was changed. By the fifth day the breast had completely healed and only minimal drainage was obtained from the arm. She continued to gain weight normally. On the seventh day the drain was discarded and an X-ray of the right shoulder showed definite osteomyelitis of the upper third of the right humerus. On the fifteenth post-operative day the sinus closed and the swelling and tenderness practically disappeared. The erythrocyte sedimentation rate was normal and her white blood count 18,500. Gamma globulin levels were checked and found to be normal. She was then allowed to use the arm, and by the 20th day all signs of the psuedoparalysis had disappeared. Subsequent X-rays showed progressive spread followed by healing of the process (Fig. 1). She was discharged on her 36th hospital day in good condition, weighing 11 pounds 12 ounces, and with a white blood count of 10,500. She has been seen regularly in the outpatient clinic for six months since discharge, and no sign of recurrence has been detected clinically or radiologically. Her last X-ray is shown in Fig. 2. She has complete use of the affected arm, and in every way has completely recovered.

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*The authors wish to express their appreciation to Dr Melvin Reinhard, Chief Radiologist, Dhahran, for his assistance in interpreting the roentgenograms

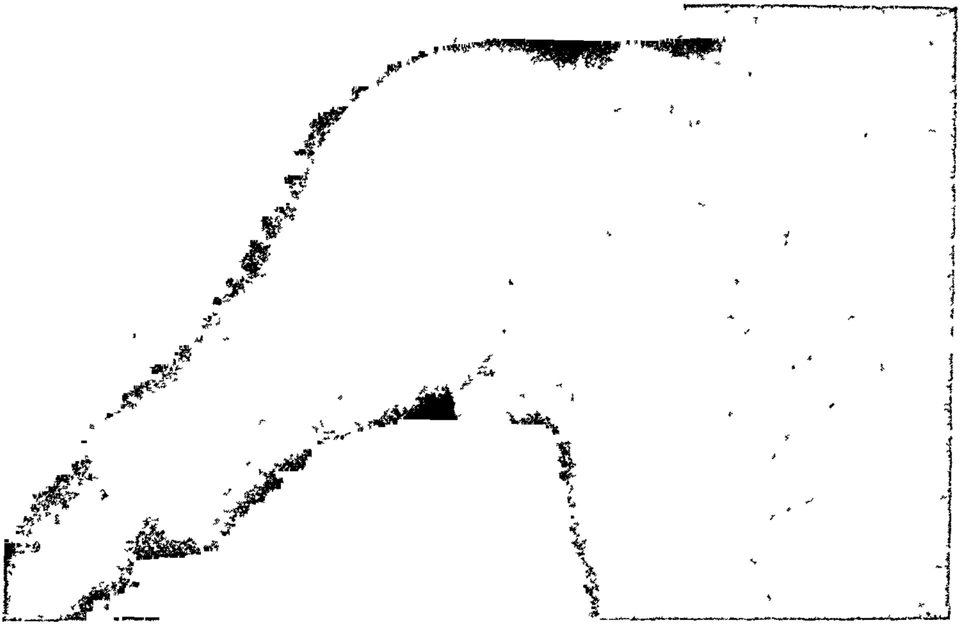

FIG. 1. X-ray showing osteitis of right humerus.

DISCUSSION

It is very uncommon to see a suppurative osteitis of this age group here in Arabia. This infant was born in a modern, isolated obstetrical unit, and spent her first five days in a similarly modern nursery. Her home is in a community similar to many small American towns. Where she encountered the penicillin-resistant staphylococcus is conjectural, but most probably was at home after her discharge because of her age (24 days). In the case herein reported the suppurative mastitis furnished a valuable clue to the early differential diagnosis of pseudoparalysis of an extremity. The early diagnosis plus prompt open drainage in this case led to rapid and complete recovery without recurrence or disability.

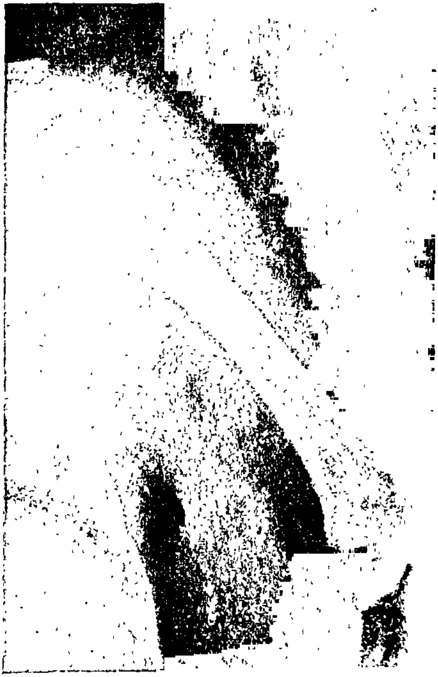

FIG. 2. X-ray showing healing of osteitis of right humerus (Picture is reversed).

SUMMARY

A case of penicillin-resistant staphylococcus osteitis of the right humerus following suppurative mastitis of the left breast in a newborn is reported.

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BOOK REVIEWS

Infant Mortality in India, 1901-1955. By S. Chandrasekhar. 1959. London : George Allen and Unwin Ltd. pp. 175. 20/-.

This book is the first detailed and comprehensive study of infant mortality in India, its causes and reasons for present inadequate knowledge. It is presented in the following five chapters —population census and vital statistics in India, the measurement of infant mortality, infant mortality in India and the world, causes and, lastly, the fight against infant mortality.

As one would expect from this distinguished authority, there is an abundance of useful material presented here in a clear and constructive form. Of especial interest are his comments on the need for better instructed mothers. He notes : " While there is no doubt that folklore contains profound knowledge and robust common sense based on centuries of human experience, there are areas where this knowledge is at glaring variance with the scientific verdict. These areas cover infant feeding, clothing and the treatment of common ailments."

In summary, one can agree with the publishers that this pioneer work will be invaluable to demographers and economists, statisticians, sociologists and public health workers, and to all students of developing tropical areas.

Communicable Diseases in School. A Survey of Existing Legislation. Offprint from the World Health Organization : International Digest of Health Legislation, Geneva. 1959. pp. 66. 3/6d.

This small booklet is most interesting and valuable. In it a survey has been made of the practices in relation to various communicable diseases occurring in school children in different parts of the world. The main finding is the striking one that there is a very great variation with regard, for example, to periods of exclusion from school of contacts or of actual patients. It is quite apparent that more uniformity is needed, while, as the report says, " too often time-consuming practices are continued long after they are outmoded."

Other topics covered in this publication include legislation ; exclusion measures ; obligations of parents, teaching staff and health services; and closure of schools.

Water Supply for Rural Areas and Small Communities by E. G. Wagner and J. N. Lanoix. 1959. Geneva : World Health Organisation Monograph Series No. 42. pp. 340. 35/-.

While for the most part this monograph is a well-written technical account of this vital subject, the first chapter also puts the case for the importance of water supplies to child health very well indeed. The background is set by the opening lines : " Invariably the progress of sanitation throughout the world has been closely associated with the availability of water ; and, the larger the quantity and the better the quality of the water, the more rapid and extensive has been the advance of public health."

The connection between water supplies and diarrhoel diseases is well known, and is of especial interest in children owing to the importance of these diseases in these age-groups. However, in tropical regions other considerations have to be taken into account, as for example, the part played by water in the spread of schistosomiasis and of infection with the Guinea worm. (The latter is strikingly apparent in Western Nigeria where the Guinea worm is common in rural areas, but unknown in children living in towns with a piped water supply such as Ibadan).

The Charity Hospital Pediatric Manual. Edited by W. Waring. 1959. New Orleans : The Print Shop, Charity Hospital of Louisiana.

This handbook contains the practical wisdom and know-how of several " generations " of house staff in the Department of Pediatrics at Tulane University, New Orleans, to say nothing of the knowledge, experience and wise guidance of the senior members of the Department.

It is extremely comprehensive and covers a wide range including every conceivable practical procedure, normal ranges of values for different laboratory tests, standards of growth and development, common household poisons, drug dosages and details of fluid and electrolyte therapy.

It probably contains too much for present-day circumstances in most tropical pediatric units, although because of its handy loose-leaf form, the less useful sections can be left aside easily. Similarly, there are, as would be expected, areas of importance to the tropical pediatrician which are not covered, as, for example, malaria, liver biopsy and spleen puncture.

These are, however, minor criticisms and it is the reviewer's opinion that this is the best handbook of this type that is available. For the tropical pediatrician, it represents an excellent and compact collection of practical information, which he could either prune of material of little use to him, or alternatively, use as the basis for a local booklet of this type.

NUMBER THREE June, 1960

African Child Health

This Section of the Journal is devoted entirely to papers dealing with the health and welfare of the African Child

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CULTURE AND THE PROBLEM OF HUMAN WEANING

by

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The complex biological process of weaning which all mammals have undergone since their evolution, has been receiving recognition of late, particularly in the human species, as a hazardous, rather than a natural process The wide variations found in different societies in the time and method of weaning, the reasons for the cessation of breast feeding, the ritual and beliefs associated with the process, and the effects of weaning on the species add enormously to the intricacy of the study As compared with some animal species, humans set about the process consciously , it is this conscious act which seems to be changing the process from a natural milestone in life to an experience to be endured

Recently, interest in the subject has been shown by social scientists describing the practices and customs of societies, by physicians and nutritionists faced with the necessity of introducing sufficient and adequate dietary supplements, and by practitioners of psychology endeavouring to explain human emotional and psychical abnormalities

The term " wean " is derived from the Anglo-Saxon *awenian* to accustom (a child or young animal) to the loss of it's mother's milk It is recognised that weaning may be partial or temporary, as when a mother is ill or incapacitated, or a rural African mother is doing the seasonal ploughing, planting and weeding of the crops In this text, however, weaning is taken as indicating the complete and permanent cessation of suckling

Present-day knowledge about weaning revolves around varying aspects of the process, and it will be necessary to examine some facts in greater detail

WEANING TIME

Under this heading must be included the different phases of time

(a) the age of the child at which weaning occurs
(b) any seasonal or ritual times of weaning and
(c) the time of weaning as determined by the developmental level reached by the child

(a) *The age of the child at the time of weaning* Social anthropologists, missionaries, medical practitioners and others have recorded the ages of children at weaning in many different non-literate unsophisticated societies, while some details are available about modern societies, and Table I summarises some of the recorded ages of infants at weaning in different societies.

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It can be seen that, in general the period of breast feeding is much longer in non-western societies, the earliest time of weaning being well over one year, extending even up to 15 years in the Eskimo. On the other hand most mothers in the United Kingdom have weaned their infants by the age of 6 months, this presenting a remarkable change from the mother of the 19th and early 20th Centuries. In the 18th Century, the Western mother herself breastfed her child or employed a wet nurse for the purpose, whereas her modern counterpart knows the composition of cow's milk, and the supply is ready — in effect " the cow is now being used as a mother substitute." (Spence, 1938).

No study could be found which has assessed the impact of Western ideas of breast feeding on non-Western societies ; but it has been observed by the staff of the Polela Health Centre that rural mothers, when employed in towns, are weaning their babies earlier. Motivated by economic factors, they resort to the bottle and dummy of the Western mother. These apparently permit the African baby to be weaned early, and deposited in the care of the elderly grandmother in the Reserve (the rural area in South Africa inhabited by Africans), whilst the mother returned to her employment in the city.

Table I. Age of children at weaning in different groups.

	Age of Child	Year
Non-Western Societies :		
Basuto (Ashton, 1952)	Av. 2 years (1-3 years)	1952
Bareshe* (Richards, 1932)	Av. 3 yrs. 3 mths. (males) „ 4 yrs. 4 mths. (females)	1932
Burmese (UNESCO, 1953)	3—4 years	1953
Chinese (Feldman, 1927)	5—6 years	1927
Caroline Islanders (Feldman, 1927)	10 years	1927
Eskimo (Feldman, 1927)	Up to 15 years	1927
French West Africa (Brock and Autret, 1949)	18 months—2 years	1952
Greeks (UNESCO, 1953)	14 months—2 years	1953
Japanese (Feldman, 1927)	5—6 years	1927
Kasai (Brock and Autret, 1949)	18 months—2 years	1952
Masai (Brock and Autret, 1949)	3 years	1952
Navaho (Le Gros Clark, 1953)	Av. 2 yrs. 4 months	1947
Sudanese (Housden, 1950)	2—4 years	1950
Western Societies		
Irish (Health, 1907)	2 years	1907
North America (Kardiner, 1945)	1—7 years	" old days "
English (Craig, 1946)	50% by 3 months 60% by 6 months	1943
English (Hughes, 1948)	83% by 6 months	1945
English (Dummer, 1949)	25—65% by 8 weeks	1949
N. Americans (North West) (Schlesinger, 1953)	71% by time of discharge from nursery	1953
N. Americans (South, East and South West) Schlesinger, 1953)	18% by time of discharge from nursery	1953

*It appears that the Bareshe attaches magic significance to the number 3 for males and 4 for females.

(b) *Seasonal or Ritual Time of Weaning.* No recorded study of the seasons of weaning could be found. While some physicians advise that weaning should occur in the cool season of the year, no assessment could be found of the response of mothers to this advice.

In many unsophisticated societies, there is a tribal ceremony attached to the weaning process, e g the Zulu frequently slaughter a goat or other beast to mark the occasion and to satisfy the ancestors as to its completeness, but there is no record of any ritual time for weaning in these or other groups

(c) *Developmental Stage of Infant at Weaning* Some societies determine their weaning time by the level of development reached by the child For example, among the Maori, many wean a child when it can turn over, (Best, 1924) the Zulu paternal grandmother, traditionally the person to determine the time of weaning, especially of the first-born, often decides on weaning the child at a certain critical level of ability — usually when the child can walk, run, or can talk well enough to request food In fact, it is rare to find the traditional Zulu determining the time for weaning by the chronological age of the infant

Reasons and Indications for Weaning

There are many reasons for weaning, some culturally determined, others ' medically ' determined, varying from modern to primitive peoples even within each group differences exist, but certain common features appear

In Tables II and III, some of the reasons are summarised It can be seen that in certain societies, some conditions or events motivate immediate cessation of breast feeding, e g among the Basuto and Zulu, the onset of pregnancy leads to immediate weaning based on the belief that the breast milk then would prove injurious to the suckling baby

Table II Reasons and Indications for Weaning Western Societies

Reasons for (or causes of) weaning	Year
Ignorance Inability to breast feed Reluctance to breast feed (Spence 1938)	1938
Generalised maternal illness Localised maternal illness Infant illness Economic Psychological Physiological (Dummer, 1949)	1949
Errors in technique Sweetened water (Craig, 1946)	1943
Medical Indications for Weaning Prolonged illness of mother Pregnancy Return of menses Delicate mother Mentally ill mother Drugs used by mother Unsatisfactory nursing (Bloom, 1937)	1937
Prevention of anaemia in baby (if weaned too late) Prevention of digestive disturbances (if weaned too early) Loss of weight in child (Feldman, 1927)	1927
Prevention of habit (Spock, 1952)	1952

TABLE III. Reasons and Indications for Weaning : Non-Western Societies.

Reasons for (or causes of) weaning	Year
Pregnancy : Zulu (BRYANT, 1949) Basuto (ASHTON, 1952)	1949 1952
Third month of pregnancy : Masai (BROCK and AUTRET, 1949)	1952
For resumption of parental cohabitation, (ASHTON, 1952) (i) to appease male mate. (ii) to produce further offspring (Zulu, Basuto)	1952
Economic factors (mothers having to earn) : Zulu*	1953
Discipline : Chaga (RAUM, 1940)	1940
Medical Indications for Weaning : " Umkhondo," a bewitchment syndrome manifesting with diarrhoea, loss of weight and a sunken fontanelle : -Zulu*	1953

*Personal observations.

This is modified by the Masai who wean their children at the end of the 3rd month of pregnancy (BROCK and AUTRET, 1949). This belief is not limited to unsophisticated people, for even in Western societies it is a common belief that the milk of a pregnant lactating mother is potentially injurious to the suckling child. In fact, BLOOM, (1937) states that " pregnancy contraindicates breast." It is interesting that Greek mothers are encouraged to breast feed during pregnancy, this practice being considered good for the growing embryo (UNESCO, 1953).

Many other reasons for weaning exist in Western societies ; their physicians advise slow weaning and argue that prolonged breast feeding may produce an anaemia in the child.

PEARSE and CROCKER, (1943) condemn any group system of indications or reasons for weaning, and suggest that each child is one unto itself, and should be weaned at its own time.

Socio-economic factors appear to enter into the determination of weaning. DUMMER (1949) in a study of the relationship between housing and weaning in England (Table IV), showed the higher proportion of children weaned by 8 weeks of age to be among the families in rooms, or living with in-laws, than among those living in other housing.

The non-western mothers wean their children because of the onset of pregnancy, the developmental level attained by the child, or the need for resumption of parental cohabitation. Housing does not appear to enter into the process but the economic need for some African mothers to re-enter employment may cause the weaning to be effected.

TABLE IV. Correlation of Housing distribution with percentage of babies weaned by 8 weeks. (North Hertfordshire, Great Britain, 1949), (DUMMER, 1949).

	Sharing	Detached	Semi-detached	Flat	Rooms	With in-laws
Overall (N = 545)	8.1	7.2	48.5	9.1	11.7	15.4
% weaned by 8 weeks	25.0	26.6	33.4	31.2	39.6	40.0

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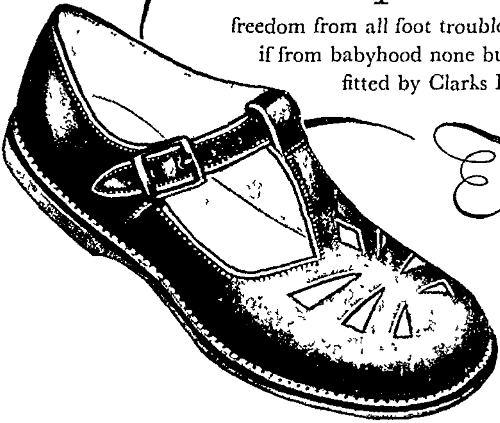

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METHODS OF WEANING

These vary widely from culture to culture (Table V), the Western mother depending mainly upon the early and gradual introduction of dietary supplements, with the bottle and/or dummy available to meet the sucking demands of the infant, and then the withdrawal of the breast It is as well to remember, however, that in England during the middle of the 15th Century, other methods were used As described in Jacob Well (about 1440) (quoted by Oxford English Dictionary) that " whan the modyr wanyth here child, sche wetyth here tetys wyth sum byttere thyng " The use of applications to the breasts is still frequently the practice in unsophisticated societies, but the variation among them is wide too

TABLE V Methods of Weaning in Some Unsophisticated Societies

Society	Applications to breast	Other Methods
Zulu (Personal observations, BRYANT 1949 , ALBINO and THOMPSON 1946)	Bitter aloe juice, snuff	Temporary adoption imFingo cycad tied around neck to make it forget Fly around neck to stop crying
Mundugummor (New Guinea) (MEAD, 1948)	Bitter sap	Thrust away or slapped
Antimelangers (DU BOIS, 1941)		Pushing child away or placing breast beyond reach
Thonga (RICHARDS, 1932)		Temporary adoption
Samoa (RICHARDS, 1932)	Lime Juice	
Manus (RICHARDS, 1932)	Human hair	
Omaha (MEAD, quoted LE GROS CLARK, 1953)		Temporary adoption
Zuni (MEAD, quoted LE GROS CLARK 1953)		Mocking
Greeks (UNESCO, 1953)	Bitter stuff	Sweetened cows milk offered
Tchambuli (MEAD, 1948)		Stuffing infant s mouth with delicacies
Basuto (ASHTON, 1952)	Tobacco, Aloe juice tight cloth	Prepared by mocking of neighbours Temporary adoption
Maori (BEST, 1924)	Bitter sap of Kawakama fern	
Comanche (KARDINER, 1945)	Bitter stuff	Temporary adoption Porcupine tail on cradle for quick weaning
Alorese (KARDINER, 1945)		Pushing, away slapping and teasing

Some non sophisticated mothers introduce supplementary foods early in infancy, and ultimately, with the breast milk minimal, use the breast as a supplementary comforter The Chaga, for example, believing that the mother's milk is insufficient, spit food into the baby's mouth from the second day of the infant's life, and with gradual introduction of foods, the breast serves just as a comforter However, the ultimate weaning is recognised to be distasteful and is the occasion of the first disciplinary action, (RAUM, 1940)

Similarly amonst the Atimelangers (mountain villagers of the East Indies), premasticated foods and gruels are offered early in the baby's life, this feeding being increased as the baby's ability improves, but the weaning is effected by pushing the child away, or placing the breast beyond reach (DU BOIS, 1941)

Among the traditional Zulu, foods are introduced even before breast feeds, because of the belief that colostrum is injurious to the infant The breast is withheld for the first 24-28 hours, or even longer, during which time other forms of food are given In pre-20th century times, *amaas* (curds of soured milk) was given to the baby immediately after birth, but now with the great shortage of milk in the reserve areas (in Polela, even in the best season, and with an equal distribution, 1/20th of a pint is available per person per day), *ncumbe*, a finely sieved pulped maize and water gruel is used as a substitute. This is introduced a few hours after birth, any resistance by the infant being overcome by forcibly pouring the gruel from the cupped hand into the baby's mouth with the nose held closed, or more recently by the use of a feeding bottle. Breast feeds are introduced after 1 to 3 days, and then continued, with feeds of *ncumbe*, other maize dishes and milk, when available, being gradually introduced.

The ultimate weaning, after this gradual introduction to other foods, is facilitated either through a piece of *iMfingo cycad* plant which is strung around the infant's neck in order to make it forget, or if the baby remembers, through the application in the presence of the baby, of *umhlaba* (bitter aloe juice) to the nipples. The infant is then repeatedly offered the breast during the day. In most cases, a charm is tied around the baby's neck to encourage it to forget the breast. The charm may consist of a fly because of this insect's inability to cry, a cockroach so that its large appetite may encourage the baby to eat well, or *iMfingo*, breast milk or baby's tears, all of which are said to make the child forget the breast. Often, temporary adoption is imposed, the weanling being removed for a period to the maternal grandparent's home.

As can be seen in Table V similar methods are employed in most unsophisticated groups, with various applications or measures being used to make the breast distasteful to the child.

However, indications for early weaning do arise, e.g. amongst the Zulu pregnancy during early lactation is a decisive reason for immediate weaning, or the onset of a persistent diarrhoea with green stools (usually diagnosed by the witch-doctor as *umkhondo*, a syndrome carried to the baby through breast milk from a bewitched mother, which is treated by immediate weaning). In these circumstances the drastic measures are introduced for the cessation of suckling, often before the baby has been adequately established on supplementary feeds.

THE EFFECTS OF WEANING

It is generally recognised that weaning may produce certain effects, but their nature, immediate or late, are not entirely agreed upon. Possible emotional disturbances are closely connected with any nutritional disorders produced.

IMMEDIATE EFFECTS OF WEANING

These, as yet, are not clearly understood and are still a matter of conjecture and argument. RICHARDS (1932) decries the lack of anthropological contribution to the study of weaning as a change in the way of life, mentioning that the magic and ritual of the process received all the attention of the writers on the subject. LE GROS CLARK (1953) reasons that some anthropologists may be forgiven on the grounds that " the mating habits and taboos of savages are doubtless more intriguing than what happens to babies, many of whom will probably be dead anyway before they are three years old." RICHARDS (1932), PIDDINGTON (1950) and MALINOWSKY, (quoted by RICHARDS, 1932) suggest that the savage infant, contrary to the child of well-to-do parents is not weaned until it has developed emotionally a much more complex attitude towards the mother, and until it has reached physiologically a more or less independent stage. RICHARDS argues that the effects of weaning are thus minimised but she does not suggest what the effects are.

Weaning does cause the first barrier between a previously indulgent mother and the child, at an age when breast feeding is associated more with sensual pleasure for the child

The wrench may be worsened by the non-sophisticated mother not caressing or fondling the child, who depends entirely upon the breast for providing care (Richards, 1932) and by the child understanding the punishing nature of the process (Piddington, 1950)

Psychologists and psychoanalysts generally agree that there are immediate effects on the child at weaning , Freud (1949) writes " the child will always resent weaning, even at a later period, because of its association with mother," but there are few descriptions of any prospective studies of these effects

Friendlander (1947) mentions that the child, despite its ability to displace on to another object, e g a bottle, must give up instinctive pleasure by losing the close intimacy of body contact with mother, but he does not describe any actual immediate effects

Almost all descriptions of these effects are based upon psycho-analysis Analysts describe acts of aggression by the weanling, resulting from the unsatisfied love and desire for the breast They maintain that the deprivation of the breast acquaints the child with reality, and he is made aware of his love (in the form of desire) and his own dependence (in the form of need) A depressive phase commences with his mourning for the breast, aggravated by guilt feelings , dependent upon the child's belief that the loss of the breast was due to his own greed and aggression (Klein, 1948 , Klein and Reviere, 1953)

The only available prospective study of the changes occurring among a group of babies at weaning was made by Albino and Thompson (1956) They studied 16 Zulu babies (average age 18 9 months), and 10 controls (average age 23 6 months), performing pre-weaning assessments, and observing the process and the weanling's reactions at the time and afterwards By providing adequate nutrients in the form of dried milk powder they attempted to offset any nutritional disturbances resulting from the loss of breast milk They found that the children studied were disturbed by the application of the *umhlaba* to the breast Some even refused the breast without a prior taste of the bitter application Later behaviour disturbances were frequent, consisting of aggressiveness, particularly towards the mother, but also towards others, accompanied by bouts of fretfulness and/or apathy This was followed by positive attempt to gain the mothers' love and finally a period of increasing independence away from the mother

The early change in behaviour has been noticed by the physicians of the Polela Health Centre, who found that the previously playful, cheerful, co-operative baby, soon after weaning displayed violent tantrums, withdrawal, extreme tensing of the body, screaming, biting and gross active resistance to the same physician's advances

An interesting finding in the study was a sudden increase in maturity of behaviour from the 5th to the 13th day after the weaning The weanlings appeared to spurt forward in their domestic activities in the homes and in their desire to assist with the family chores Some developed an increased facility in speech, and a greater independence of the support of adults

Clinically, physicians have noted effects of weaning, varying from death to minor digestive disturbance As long ago as in the 14th century, weaning was recognised as a process fraught with danger, " as a childe that has nede to be on his modur kne, and fostird with hur mylke, perisch if he be wenyd, and taken fro mylke " (Oxford English

Dictionary after HAMPOLE, C. 1300). Similarly, high mortality rates have been observed among prematurely weaned rural Zulu babies (Polela Health Centre, 1949).

GILLMAN and GILLMAN (1951) note that in South Africa, where the price of eggs and dairy products is beyond the African's means and where even the staple diet of mealie meal (maize meal) is no longer home-grown, " it is not entirely unexpected that the weaning of African babies is attended by an extremely high mortality rate." Among Kenya Africans, JOHNSTONE (1925) (quoted by the GILLMANS), found a death rate at weaning between the ages of 9 and 18 months, of 21.7 per cent.

It is amazing that the effects of weaning have not been studied more by physiologists, for very few descriptions of this inevitable process occupy a place in physiological text books, so that we are unable to estimate any changes that must surely occur, within the range of normality and below the clinical disease level.

Even Western medical practitioners' interest in the problem is not great, probably because of the availability of a mixed diet to meet the dietary requirements of a Western society, in which cows milk figures largely. The African baby, after weaning, passes abruptly to the diet of the family, consisting almost entirely of carbohydrate foods, because of the unavailability of other supplements, especially cows milk (BROCK and AUTRET, 1949).

It is thus that the acute nutritional deficiency amongst the African babies often arises. Kwashiorkor is a common disease of African babies, all too frequently following weaning. LE GROS CLARKE (1953) suggests that up to then the prolonged breast feeding had managed to supply the minimal necessary requirements to supplement the carbohydrate diet, but it is possible that non-dietary stresses of weaning play a part in the pathogenesis of kwashiorkor.

As GILLMAN and GILLMAN (1951) point out, even in the healthy, gastro-intestinal upsets may follow weaning ; they add a rider too, as a result of their animal experimentation that a change from a *bad* to a *good* diet may result in morbidity or even mortality.

Most medical practitioners suggest that digestive disturbances do occur with weaning, but that these are minimised by gradual introduction to other foods. Anaemia in the child, is presented as a result of late weaning, especially where other adequate supplements are not introduced early on.

Despite the emphasis of study being directed towards the harmful effects of weaning on the child, the mother certainly enters into the problem. It has been noticed that the previously placid African mother frequently changes her attitude, emerging from weaning as a non-indulgent, forceful feeder, e.g. the mothers of the Tchambuli tribe stuff their infant's mouths with delicacies to stop them crying (MEAD, 1948). The Basuto mother, after weaning, tends to " snap at the child and treat it harshly with no cuddling or coaxing" (ASHTON, 1952).

It is recognised that weaning releases the infant from the vagaries of the mother's diet ; this would appear to be important in a malnourished pellagrous African mother, whose nutritional state may permanently alter the metabolic physiological regulations of the infant (GILLMAN and GILLMAN, 1951). This has been seen in Polela, where the rearing of the infant of a pellagrous Zulu mother is frequently fraught with crises.

In addition, the temporary adoption of the African infants by the maternal grandmother makes the physical break between mother and child greater, especially in patrilocal society where the weanling might not see the mother for weeks or even months.

Changes in Family Relationships after Weaning. In many African societies, sexual intercourse is forbidden during lactation, and weaning heralds the time for resumption of cohabitation between mother and father This does not often occur in private, so that the parental relationships are observed by the child (Richards, 1932 , Piddington, 1950), This tends to increase the reactions of the weanling, especially of a male child, who is separated from his mother and his sensual (sexual) satisfaction, while he observes his father resuming sexual possession of his mother and becoming first claimant for her love and attention This may result in infants wandering off for days, and lead to intense hatred of the mother and father (Ritchie, 1943)

This resumption of sexual relations is not only to gratify the father's urges, but also to produce further children In fact, the Basuto mother, realising this, may postpone weaning as long as possible "*as they like suckling and do not regard child bearing as* an unmixed pleasure" (Ashton, 1952)

With weaning changing his diet, the child enters into the family's social activity in relation to food-making, and must compete with the fellow children for food It is then that rivalry commences and emotional ties are formed with other children Albino and Thompson, (1956) in fact, report a post-weaning attachment of the child to some other member of the family

Changes in the Parents associated with Weaning Mother Few physical changes in the mother in weaning have been described, but it is well recognised amongst the Zulu that the lactating mother loses her temporal hair (*ubu tete*) and regains this soon after weaning (Bryant, 1949)

Father Apart from the satisfaction of his sexual urges, no effects on the father have been ascribed to the weaning of his child

REMOTE EFFECTS OF WEANING ON INFANT

Almost all the remote effects of weaning are described by psychoanalysts who attribute some disturbances to the deprivation of the breast, and a maladjustment following it Traditional Zulu do not attribute any psycho-pathological states to weaning and believe that the infant soon forgets the loss incurred

However, remote biological effects are possible, so that with ever-earlier weaning becoming customary, a human race may ultimately be bred, incapable of breast feeding at all

The possibility too, that premature weaning may cause the diatheses that determine the direction of future abnormalities or degenerative diseases in adulthood, has been suggested (Spence, 1938 , Pearse and Crocker 1943) but no confirmatory study has been described.

It is not generally agreed that adult personality and behaviour are related to weaning The positive relationship of adult states to weaning has been measured by psychoanalysts in studies of adults, but no follow-up study from the weaning time has been recorded

Klein (1948) believes that the release of the Oedipus complex is timed by the frustration caused by weaning, which arouses feelings of guilt in the child , and that the complex in this way leads to neurotic troubles and disturbances of potency and depressive states in adulthood

Eysenek (1952) too, agrees that there is a definite correlation between weaning and character In a study of 115 middle class adults, he found that the orally gratified type (late weaners) were the optimists, generous, bright, ambitious and accessible to new ideas, while the ungratified type (early weaners) were the pessimists, moody and depressive, with feelings of insecurity

However, others deny any such correlation in studies of nursery and school-aged children, adolescents or even adults (THURSTON and MUSSEN, 1951 ; PETERSON and SPANOT, 1941). Others suggest that the age of infants at weaning plays an important part in the determination of adult responses.

CHILDERS and HAMIL (1932) found a lower incidence of " abnormal behaviour manifestations " in children who had been breastfed less than 1 month and more than 5 months, as compared with those breast fed for 1-5 months. This is supported by MASLOW and SMILAGYI-KESSLER (1946) who found that the highest scores on a test of security were made by students breast fed little or not at all, or fed for longer than one year. The method of weaning too, appears to affect the results and as KLEIN and REVIERE (1953) remark, " the normal psychological growth of an infant depends on the slow and gradual detachment from mother."

It would appear, therefore, that psychologists recognise the trauma associated with weaning, but disagree on the remote effects produced, and the relationship to adult behaviour.

Prolonged thumb and finger sucking, which is probably a manifestation of an ungratified oral phase and all too common in Western societies, is extremely rare among the rural Zulu, or among other unsophisticated peoples (MEAD, 1948). Further, among the Zulu, this habit is almost entirely confined to the prematurely weaned child.

REMOTE EFFECTS OF WEANING ON MOTHERS

Mothers who have breast fed their children successfully seem to be different from those who weaned their children early, or never breast fed. Perhaps it is due to a " glowing " satisfaction at the fulfilment of the maternal role, or the realisation of most mothers' desires. This has been observed by SPENCE (1938) who described his finding a woman who has successfully breast fed an infant " to be a saner and more sensible woman than her sister who has failed to do so."

DISCUSSION

It has been shown how varied a process the weaning of humans is. The time and method of weaning is culturally determined, and often specific to each society, the causes of weaning differ widely, and include a physiological state of pregnancy, a pathological state such as diarrhoea, or illness in the mother, while socio-economic factors including housing, and the apparent necessity for mothers to work enter into the determining factors.

Our evolutionary predecessors were possessed of infants, less dependent and more able to fend for themselves. The agility of the baby monkey in clinging instinctively to its mother, finding the nipple, and soon learning the mother's methods of seeking food leads to self-demand breast feeding and ultimate self-weaning when capable of feeding itself. This permits of no necessity of conscious entry of the mother into the process, so that in most lower mammal species, weaning is the resultant of the young acquiring the species-feeding habits, and thus reaching mature self-sufficiency.

But with its evolution, the human infant is now entirely dependent for feeding, with remnants such as the grasp reflex of the hands to remind us of its ancestry. Fairly early in its existence, the human infant takes everything to its mouth, but only relatively late in its existence is the child capable of obtaining the food for itself, and socialised enough for self-feeding. The conscious entry into weaning by the mother deciding the time and method, be she Westernised Briton or unsophisticated Zulu, is now constant in all humans.

It is obvious that most groups, little influenced by Western societies, wean later than present day Western mothers, unless sudden contra-indications to breast feeding arise But with the rapid Western-style acculturation of the unsophisticated societies, weaning amongst them may occur earlier in infancy This must raise the evolutionary possibility of the human female checking the function to such a degree as to reproduce descendants with the function lost, and procreating females incapable of breast feeding at all

The human race then would be entirely dependent upon the production of artificial foods, itself an unpredictable factor Perhaps dietetically the loss of breast milk can be made up with artificial complements, especially using cow's milk, but it is recognised by most that weaning is psychologically traumatising If so, then it is improbable that the weanling's needs are adequately supplied without the use of the breast, despite a sufficiency of calories, proteins and other dietary constituents

But the emphasis of medical study being on the values and constituents of breast milk, most Western medical advisers recommend weaning at a certain time, presuming that adequate foods are available On the other hand, Zulu mothers, maintaining their prolonged breast feeding as a form of comforting, do not realise, from the birth of the infant, the food value of breast milk, and when asked what the young infants are fed on, frequently reply, " *lutho* " (nothing) To them the breast is primarily a comforter and maintains this function until weaning, being offered to the child on all occasions of stress and crying Weaning removes their child's comforter, so that sweetmeats and delicacies are given to appease the child for its loss, while any other available foods are given to satisfy hunger The Zulu mother does speak of the weanling " missing " the breast, but believes it to be soon forgotten

As westernisation encourages early weaning all over the world, the problem of adequate foods arise , the plight of the recently westernised groups without access to the essential foods is becoming increasingly difficult

But is the Western child weaned in the first year of life, on to a diet, adequate in all the necessary requirements, really on the right road to health ? It is always argued that even babies never breast fed do as well as others breast fed for years The psychoanalysts contend that they can always detect a yearning for the breast in them, but this practice is not entirely accepted universally

Even more important, perhaps, this argument merely reveals our lack of knowledge about health and its assessment As measured by somatometric clinical and developmental tests, a baby, never breast fed, may be labelled " healthy " but modern science is incapable, as yet, of assessing the early laying down of diatheses to illhealth which may be manifested only in adulthood Only by long term study will some progress be made , examination not only of the weanling but all concerned in the process , especially the mother who, when consciously making the weaning decision, could readily be filled with the feelings of guilt at depriving her child of the breast, and manifest them in some form of disturbance

Until such time, it would be probably best to familiarise the child with the diet of the family, slowly accustoming the child to the foods available This would permit of each child weaning itself when it reaches that stage of maturity and development

It is possible that the Zulu mother copies this, weaning the child when it is ready for the next step towards maturity , this showing as the increased socialisation effect described by ALBINO and THOMPSON (1956)

Far too many systems, timings and methods of weaning have been dogmatically ritualised. Each child is one unto itself. As PEARSE and CROCKER (1943) aptly put it, " so capable in applying therapy are we, that we have almost ceased to look for the causes that necessitate it." We seem to be forgetting "that each child is the product of its own nurture, and must move forward according to its own specificity and at its own inherent tempo."

The problem of weaning is a complex one, and the need for a long-term study of all its dynamic intricacies by those concerned with the humanities should certainly prove to be of the greatest interest.

SUMMARY

The complex intricacy of the process of human weaning is presented. The variations in time and method of weaning in different societies are shown. The immediate and remote effects of the process of weaning are discussed. In view of a possible biological species-change resulting from the curbing of the breast feeding function, the need for a long-term study of weaning is presented.

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EDITORIAL

NUTRITIONAL REHABILITATION AND TROPICAL MATERNAL AND CHILD HEALTH

The concept of nutritional rehabilitation, although difficult to define with precision, is nevertheless a useful one in practice It refers to the ill-defined borderland between classical " treatment " and " prevention," and essentially is concerned with attempting to restore to nearer normal with supplements (including vitamins and minerals) relatively minor, often subclinical forms of malnutrition, which do not require hospitalization or for whom hospital accommodation is not possible, owing to various factors, including pressure on beds by more serious disease Plainly, the scope of this definition varies with the local circumstances , children that are being nutritionally rehabilitated in a tropical region might be admitted to hospital in a region of the world with more adequate medical facilities

The principal site for this type of activity will usually be the health centre, especially the maternal and child health section, as this will contain many mothers and young children in need of this type of approach

Some persons in the following groups may require nutritional rehabilitation, in addition to advice with regard to diet, in the following ways in some countries (Dr J Bengoa — personal communication), although, as usual, detailed policy will have to vary with local circumstances

(i) Pregnant women : iron or calcium or thiamine (usually in the last trimester), protein (*often as skimmed milk powder, if indications,* such as inadequate weight gain or muscle wasting).
(ii) Lactating mothers : thiamine, protein (if inadequate flow of breastmilk).
(iii) Pre-school children : iron, protein (probably skimmed milk), given for a limited period, accompanied by health education concerning widening of diet to include the full range of local foods.

Another suggestion that warrants careful consideration is that small units might be developed attached to child health centres, both for nutritional rehabilitation of milder protein-calorie deficiency combined with health education of the mothers of the children concerned. This combination of correction of lesser degrees of malnutrition, while at the same time attempting to modify the mothers' ideas concerning child feeding, might be extremely valuable and would certainly be an example of the present-day synthesis of what in the past had been artificially divided into " curative " and " preventive."

ABSTRACT

THE PROBLEM OF GASTRO-ENTERITIS AND MALNUTRITION IN THE NON-EUROPEAN PRE-SCHOOL CHILD IN SOUTH AFRICA (Robertson, I., Hansen, J. D. L. and Moodie, A. (1960) *South Afr. med. J.*, 17, 338).

Gastro-enteritis is the top cause of death in the non-European pre-school child in South Africa. The magnitude of the problem is shown by the fact that, in a six month period in Cape Town, 9,000 affected children were treated, of whom 1,185 needed parenteral rehydration.

Factors responsible were felt to be enteral infection, malnutrition and especially feeding practices, particularly failure of lactation.

Possible methods of prevention and cure are discussed in this topical paper.

INFECTION AND KWASHIORKOR*

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Workers with first-hand experience recognize that the overwhelming majority of clinical cases of kwashiorkor represent the effects of both protein malnutrition and infection The two may be said to be synergistic in their effect, and the net result is more serious than would be the consequences of either infection or protein malnutrition acting alone Infection may, of course, influence any stage in the development of severe protein malnutrition It may serve to aggravate the acute episode, interfere with recovery, or even be the final cause of death

Nearly all reports on kwashiorkor mention that the history of children admitted to the hospital with this syndrome very frequently includes an infectious episode several weeks before For example, Jelliffe et al, (1954) in Jamaica, Van Der Sar (1951) in Curaçao, Waterlow and Vergara (1956) in Brazil, Purcell (1939) in Ghana, Pretorius et al, (1956) in South Africa, Gerbasi (1956, 1957) in Sicily, De Silva et al, (1953) and De Silva (1954) in Ceylon, Gopalan and Ramalingaswami (1955) and also Gupta (1958) in India, Cicely Williams (1953) in Africa and Asia, and Behar et al, (1956, 1958) in Central America, all stress the high frequency with which diarrhoea of infectious origin is an immediate precipitating cause of clinical kwashiorkor These authors recognize, however, that other infections may also have a similar effect Review articles by Brock and Autret (1952), Autret and Behar (1955), Jelliffe (1955) and our INCAP group (Scrimshaw et al, 1955, 1957 , Behar et al, 1956) have all stressed this point and they, as well as DeMaeyer (1955) in the Belgian Congo, Restrepo Molina (1955) in Colombia, and Netrasiri (1955) in Bangkok, have called attention to the frequency with which measles is sometimes responsible for a considerable number of cases of kwashiorkor DeMaeyer also states that tuberculosis may play a similar role (1955) As Trowell et al, (1954) indicate in their book " Kwashiorkor," almost any infection is capable under certain circumstances of aggravating a pre-existing protein deficiency and producing the clinical signs of kwashiorkor as a result

Because of the frequency with which intestinal parasites are found in children with kwashiorkor, there has been much speculation regarding their contribution to the development of protein malnutrition Authors such as the Gillmans (1951) in Africa, Thomson (1954) in Malaya, Stransky and Reyes (1955) in the Philippines, Peña Chavarria et al, (1948) in Costa Rica, Jelliffe (1953) in Western Nigeria, and De Silva (1953) in Ceylon, have suggested that the high frequency of ascaris in their kwashiorkor cases must be a contributing factor, and Symonds and Mohammed (1956) and Symonds (1958) believe hookworm in the mother adversely affects lactation performance and thus contributes to infant malnutrition in Trinidad Brock and Autret, (1952) and Platt (1957) from their experience in Africa, and Gupta (1958) in India are representative of the many who feel that parasites are almost always an additional stress factor in the pathogenesis of

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kwashiorkor. It must be noted, however, that in areas in which kwashiorkor is prevalent, intestinal parasites are as common in children of the same age without kwashiorkor as in those with this condition. It is difficult, however to find published records to document this statement for most areas*, and little consideration has been given to the relative intensity of the infection in the two cases.

MECHANISMS OF THE EFFECTS OF INFECTION ON NUTRITIONAL STATUS

Infection has an adverse influence on nutritional status in at least three ways, one subjective, one cultural and one physiological. As to the subjective effect, it is scarcely necessary to point out that the child with an infection, particularly when it is an enteric one, experiences anorexia and may fail to eat an adequate diet even when it is offered to him. In our experimental studies if the child with infection is forced to consume the amount of food required, nausea and vomiting are likely to develop and the purposes of the original experiment are obscured. The cultural mechanism is the tendency for the mother to change for the worse the diet of the child with infection, even eliminating all products of animal origin and greatly reducing the amount of solid food given.

The third known mechanism, and one which may be labelled physiological or perhaps metabolic, is the direct effect of infection on the nitrogen balance of the individual. As early as 1884, MÜLLER reported an increased urinary nitrogen excretion over a period of 8 days in a patient with typhoid fever. In 1909, SHAFFER and COLEMAN reported that a net loss of 15 to 20 grammes of nitrogen per day was not unusual in the early stages of typhoid attacks in muscular individuals. Additional data to this effect were published by ROLLAND (1912), COLEMAN and GEPHART, (1915), COLEMAN and DUBOIS (1915) and by KRAUSS (1926). KRAUSS also demonstrated reduced nitrogen retention in febrile pulmonary tuberculosis as noted several years earlier by MCCANN (1922).

KOCHER (1914) described a patient with paratyphoid disease who excreted from 14.5 to 16.0 grammes of urinary nitrogen daily with an intake of 2.2 grammes of nitrogen and he obtained similar results in patients with pneumonia, acute polyarthritis, pyelonephritis and erysipelas. COLEMAN et al, (1922) could not distinguish between the severe adverse effects of erysipelas and typhoid fever on nitrogen retention ; and CECIL et al, (1922) found the nitrogen losses with arthritis to be comparable to the figures mentioned.

The protein losses in meningitis have been shown by GROSSMAN et al, (1945) to be large and prolonged. Even the removal of infected tonsils has been found to bring about a striking improvement in nitrogen retention in children by JOHNSTON and MARONCY (1938) and later by JOHNSTON and WATKINS (1954).

Evidence for the adverse effect of infection on nitrogen metabolism is not limited to bacterial infections. VENKATACHALAM and PATWARDHAN (1953) have shown clearly that nitrogen absorption is improved when a child's ascaris are removed and, at least in rats, elimination of malaria parasites may improve nitrogen retention according to DEMA et al, (1959).

Surprisingly, there are no published records of the effect of virus infections on protein retention. The many reports on association between measles and kwashiorkor, as well as such observations as those of SPICER as long ago as 1892 that children with measles, whooping cough, or malignant varicella often develop xerophthalmia, suggest, however,

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*An article entitled " Worm infestations in infants and children of pre-school age in Indore " by J. N. Pohowalla and S. D. Singh has since appeared in the *Indian J. Ped.* **26** : 459, 1959, which reports the same prevalence of parasites among 727 children with and 995 without malnutrition.

that virus diseases may have as much or more action in precipitating nutritional deficiencies than those of bacterial, protozoan and helminth origin , certainly they should be thoroughly studied

In their classic text book, Peters *and* Van Slyke *(1946) discuss the way in which* infections may act to bring about a decrease in net nitrogen retention They suggest that infections cause a toxic destruction of cellular protein which, in turn, results in the increased nitrogen excretion in the urine which is observed in infection The degree of increased metabolism associated with fever is not sufficient to account for the magnitude of the effect

Similarly, even in cases of diarrhoea, the effect is not accounted for by decreased absorption, as was recognized as early as the 1915 studies of Holt et al More recently, Chung (1948) and Chung and Viscorova (1948) have called attention to the relatively good absorption of nitrogen even in the presence of diarrhoea

Confirmation of the role of toxic destruction of protein as opposed to the effect of fever and diarrhoea is obtained from the work with turpentine-induced sterile abscesses in dogs (Cook and Whipple, 1918, Daft et al, 1937, Yuile, et al , 1953)

Recent Incap Studies

Three years ago, in the course of nitrogen balance studies with a child recovering from kwashiorkor, Robinson et al, (1957) in the INCAP laboratories made a urine and faeces collection following one day of mild diarrhoea which occurred on the first day of a 5 day balance period When the data were subsequently calculated, it was observed that nitrogen retention had dropped from 28 per cent before the diarrhoea episode to -1 during the day of diarrhoea and that recovery was slow, even though there was no recurrence of frank diarrhoea

During the last 9 months, it has been possible to make a series of observations as to the effect of 7 cases of chicken pox which are summarized in Table I It will be noted

Table I Effect of Chicken Pox on Nitrogen Balance in Children aged 3—6 years (Fed 2 3 gm Protein/Kg 90 Cal/Kg)*

PC No	N Retention before illness % of Intake	N Retention at max effect % of Intake	Duration of effect weeks
82	+ 20	— 17	4†
91	+ 18	— 10	2
92	+ 27	+ 7	2
97	+ 28	— 4	1††
98	—	+ 4	1††
99	+ 21†††	+ 7	1††
102	—	— 10	—

* These intakes usually not achieved during illness due to vomiting
† Developed Sh[illegible]
†† [illegible]
††† [illegible]

that in each of the cases cited, there was a shift from a strongly positive nitrogen balance to a weakly positive or even a negative balance. There are several interesting points about these data that are not immediately apparent from the table. In the first place, an effort was made to maintain the nitrogen and calorie intake equivalent to that during preceding and subsequent balance periods when the child was not ill. Almost without exception, this policy was not successful because the children either flatly refused this quantity of food or vomited part of the diet when food was forced upon them. This confirms a clinical impression that food intake is spontaneously and drastically decreased by the child when he becomes ill, and that any effect of infection in increasing nitrogen excretion is superimposed on the consequences of diminished nitrogen intake.

Another point of very great interest is that the period of maximum effect on nitrogen balance sometimes came not at the time of the greatest symptomatology but in the late prodromal period of the disease. It should also be noted that the duration of the effect of chicken pox on nitrogen balance (1 to 4 weeks) is relatively long, although the latter high figure is probably due to an unknown further complication.

Table II shows the effect of several miscellaneous bacterial infections, each of which was promptly and effectively given antibiotic treatment. Despite this, these diverse infections: shigellosis, asthmatic bronchitis, bronchitis with a probable bronchopneumonia, tonsilitis and staphylococcal abscess, had an influence very similar to that of chicken pox. The diverse bacterial infections all produced a frank decrease in the percentage of nitrogen retained compared to the nitrogen intake. As was observed in the chicken pox cases, most of these bacterial infections adversedly influenced nitrogen balance for a period of at least a week, even though prompt treatment was given.

INCREASED SUSCEPTIBILITY OF CHILDREN WITH KWASHIORKOR TO INFECTION

There is little doubt that the biggest hazard which a child with kwashiorkor has to face once electrolyte imbalance has been corrected, is secondary infection. Infections not only interfere with recovery and are responsible for long stationary periods in individuals undergoing treatment, but also are one of the major causes of death in kwashiorkor. The experience in INCAP of TEJADA et al, (1956) who found two-thirds of children dying with kwashiorkor to have bronchopneumonia, is not unusual.

TABLE II. Effect of Various Treated Infectious Processes on Nitrogen Balance in Children Aged 3-6 years (Fed 2-3 gm Protein/Kg, 90 Cal/Kg)*

PC No.	Disease	N Retention before illness % of Intake	N Retention at max effect % of Intake	Duration of effect weeks
82	Shigellosis	+ 20	+ 5	1
91	Asthmatic Bronchitis	+ 18	— 8	1
99	Bronchitis Pneumonia	+ 21	— 24	2
95	Tonsilitis	+ 25†	+ 4	2
95	U.R.I. with Sinusitis	+ 25†	+ 4	1
98	Staph. aureus abscess	—	— 8	—††

* These intakes usually not achieved during illness due to vomiting.
† After illness.
†† Complicated by upper respiratory infection and additional abscess.

Although most authors who discuss kwashiorkor stress the fact that it predisposes to complicating infections, there is no clear explanation, as to the mechanism of this effect OLARTE et al, (1956) reported from the Hospital Infantil in Mexico that children with third-degree malnutrition showed a definite retardation in the development of antibodies to diphtheria On the other hand, KAHN et al, (1957) concluded that there was no reduction of isohemagglutinins in severely malnourished children Research is obviously badly needed on this aspect of the kwashiorkor problem

CONCLUSION

In the technically underdeveloped areas in which infant and child mortality is particularly high, infection and protein malnutrition combine synergistically to produce a net effect far more severe in its consequences than would result from either the protein malnutrition or the infection occurring alone in the individual or the population Infection tends to precipitate kwashiorkor by resulting in a decreased food and hence nitrogen intake and increased nitrogen loss in the urine Furthermore, children with protein malnutrition tend to have more frequent infections and these often prove fatal

Clinicians and public health workers should recognize that the problem of elevated infant and pre-school mortality must be attacked by programmes designed to combat both protein malnutrition and infection A programme to control only one of these two factors will always be incomplete and much less effective than when preventive efforts take both into account

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NOTE

Attention of readers is drawn to an interesting series of papers which have been printed in the " Quarterly Review of Pediatrics " over the past five years, entitled ' Infant Feeding Round the World "

Although usually brief, impressionistic and equalitative, these articles are valuable The countries covered range widely to include Afghanistan, Burma Uganda and Russia (The last is of particular interest, indicating as it does that in Russia, in contrast with the United States and Western Europe, breast feeding is still the customary method of rearing infants)

STUDIES ON HUMAN LACTATION

(RELATION BETWEEN THE DIETARY INTAKE OF LACTATING WOMEN AND THE CHEMICAL COMPOSITION OF MILK WITH REGARD TO VITAMIN CONTENT)

by

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Several studies have been made on the relation between the vitamin intake of lactating women and the vitamin content of breast milk. (CORYELL, et al, 1945 ; LESHER, et al 1948 ; PRATT and MACY, 1951 ; GUNTHER, 1952 ; CALZETTI, 1951 ; CUTRONEO, 1953 ; IWASAKI, 1955 ; RAMASATRI and INDRAVATI, 1957). The general trend in these studies has been to suggest a positive relation between these two variables. Most of these studies, however, were concerned with the effect of vitamin supplementation to the diet rather than with the relation between the vitamin contents of diet and milk. That the effects of such supplementation may not always be immediately evident is suggested by GUNTHER'S observation (1952) with regard to thiamine, that the content in milk responds slowly to the amount of vitamin taken orally. This may account for the observation made by IWASAKI (1955) that oral administration of thiamine supplements has only a negligible effect on the thiamine content of milk. Further, no attempts have been made in these studies to determine the degree of relationship between dietary vitamin and vitamin content in milk. That this relationship may vary with the level of dietary vitamin is suggested by the findings of PRATT and MACY (1951), who observed that the content of thiamine, riboflavin and nicotinic acid in milk increased with dietary supplementation with these food factors but the increase was neither consistent for all subjects nor proportional to the amount of intake. CALZETTI (1953) made a similar observation that increase in the vitamin A content of milk following the intramuscular administration of this vitamin was more evident in subjects showing lower starting values. More comprehensive investigations are therefore needed to determine the precise relationship between vitamins in the diet and in breast milk.

Recent observations made in this laboratory that the socioeconomic status of the lactating mother (which reflects the nutritional status of the mother) has an effect on the vitamin content of milk (DEODHAR and RAMAKRISHNAN, 1959) prompted the authors to investigate more thoroughly the relation between the diet of the lactating mother and the composition of milk with regard to the content of vitamins.

METHOD

Material and methods. The subjects of this investigation were 60 lactating women of normal health living in and around Baroda, who had been lactating from 3 to 4 months.

Collection of diet and its analysis for vitamin content. The whole day diet of the subjects was obtained by making collections of equal amounts of all the foodstuffs consumed by the subject including snacks, beverages and dietary supplements, if any, in the form of vitamins, minerals etc.

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*The author's thanks are due to the Indian Council of Medical Research for having sponsored this project, to Miss J. KAPUR for her help in collecting the diet as well as milk samples of lactating women, and to Dr. (Mrs.) R. RAJALAKSHMI for her guidance in the statistical analysis of the data and in the preparation of this paper.

For the analysis of food, separate weighings were made of each foodstuff and all the foodstuffs were then thoroughly

Ascorbic ac to the method of ROE and KUETHER (1943) Thiamine was assayed accordir by BARTON-WRIGHT (1952) The riboflavin and nicotinic acid content of food were estimated according to the method described in " Methods of vitamin assay " (1951)

A portion of the homogenised food was dried in an electric oven at 90° for 12 hours and then used for the estimation of pantothenic acid according to the method given in ' Methods of Vitamin Assay " (1951)

Sampling of Milk for Analysis Samples for analysis were collected in all cases between two feeds at about 3 p m by voluntary expression The samples were brought to the laboratory in thermosflasks containing ice powder and immediately taken up for analysis The sampling was done on three consecutive days and the average value for three samples was taken

Estimation of the vitamin contents of the milk The methods used for estimating the vitamin contents of milk were the same as those used for diet

RESULTS AND DISCUSSION

To determine the relation between dietary pantothenic acid and the pantothenic acid content of milk, the data were first classified into a frequency distribution with regard to pantothenic acid intake, and the median and the two quartiles determined for the distribution (The first quartile was 2 70 mg, the median, 4 02 mg, and the third quartile, 6 20 mg) The subjects were then divided into 4 groups according to the quartile range

TABLE I Pantothenic acid content of the diet and milk in different groups of lactating women

Classification of subjects	No of subjects investigated	Range of pantothenic acid intake (mg)	Mean pantothenic acid intake per day (mg)	Mean pantothenic acid content of milk, mcg /100 ml
Group I	15	1 39 to 2 70	1 83 ± 0 15	102 23 ± 4 80
Group II	20	2 70 to 4 02	3 33 ± 0 13	135 76 ± 3 63
Group III	13	4 02 to 6 20	5 02 ± 0 16	164 70 ± 4 74
Group IV	12	6 20 to 11 46	8 65 ± 0 63	184 27 ± 4 79

TABLE II Riboflavin content of the diet and milk in different groups of lactating women

Classification of subjects	No of subjects investigated	Range of riboflavin intake mg	Mean riboflavin intake per day mg	Mean riboflavin content of milk mcg /100 ml
Group I	15	0 10 to 0 19	0 15 ± 0 01	20 98 ± 1 21
Group II	16	0 19 to 0 25	0 23 ± 0 00	24 36 ± 1 47
Group III	14	0 25 to 0 33	0 28 ± 0 01	25 12 ± 1 65
Group IV	15	0 33 to 0 52	0 41 ± 0 01	31 00 ± 1 84

in which they fell. The mean value for the pantothenic acid content of the milk for the subjects in each group was determined. Table I shows the relation between the contents of pantothenic acid in the diet and milk.

The data were again treated in a similar manner and the subjects classified into 4 groups with regard to riboflavin intake and the mean riboflavin content for each group was determined. The results are shown in Table II.

Table III, IV and V show similarly the relation between dietary intake and the composition of milk with regard to nicotinic acid, ascorbic acid and thiamine.

It must be pointed out here that the 4 groups in the different tables are not identical and that the grouping is only with regard to the particular constituent dealt with.

Table I shows a general increase in the pantothenic acid content of milk with that of the diet. The product moment correlation between the two (calculated from the original data) was found to be statistically significant (r = 0.40). Tables II, III, IV and V show similar increases in the riboflavin, nicotinic acid, ascorbic acid and thiamine contents of milk with those of diet. The product moment correlations between the contents of these constituents in the diet and milk are respectively 0.54, 0.47, 0.65 and 0.35. It will be noted that they are all significant.

Thus the results of these investigations confirm that the vitamin content of breast milk depends on the vitamin intake of the lactating mother with regard to the vitamins

TABLE III. Nicotinic acid contents of diet and milk in different groups of lactating women.

Classification of subjects	No. of subjects investigated	Range of nicotinic acid intake (mg).	Mean nicotinic acid intake per day (mg.)	Mean nicotinic acid content of milk, mcg./100 ml
Group I	18	0.77 to 2.49	2.11 ± 0.14	103.17 ± 4.41
Group II	12	2.49 to 3.55	3.06 ± 0.10	113.38 ± 5.96
Group III	16	3.55 to 5.94	4.45 ± 0.19	127.63 ± 12.17
Group IV	13	5.94 to 8.70	7.27 ± 0.22	150.90 ± 18.51

TABLE IV. Ascorbic acid content of diet and milk in different groups of lactating women.

Classification of subjects	No. of subjects investigated	Range of ascorbic acid intake (mg.)	Mean ascorbic acid intake per day (mg.)	Mean ascorbic acid content of milk, mg/100 ml.
Group I	13	1.34	0.57 ± 0.13	2.44 ± 0.16
Group II	17	3.31	2.39 ± 0.15	2.70 ± 0.13
Group III	16	3.31 to 6.10	4.79 ± 0.24	3.23 ± 0.12
Group IV	14	6.10 to 11.41	8.54 ± 1.34	4.46 ± 0.33

TABLE V Thiamine content of diet and milk in different groups of lactating women

Classification of subjects	No of subjects investigated	Range of Thiamine intake mg	Mean Thiamine intake per day mg	Mean Thiamine content of milk mcg /100 ml
Group I	14	0.09 to 0.26	0.21 ± 0.01	11.51 ± 0.78
Group II	16	0.26 to 0.46	0.36 ± 0.02	11.59 ± 1.06
Group III	16	0.46 to 0.76	0.58 ± 0.01	13.16 ± 1.00
Group IV	14	0.76 to 2.74	1.23 ± 0.29	15.86 ± 1.14

investigated, namely pantothenic acid, riboflavin, nicotinic acid, ascorbic acid and thiamine, and underline the need for an adequate diet for the lactating mother in order to ensure the adequacy of breast milk for the infant with regard to its vitamin requirements

SUMMARY

The diets and the milk of 60 lactating women were analysed for pantothenic acid, riboflavin nicotinic acid, ascorbic acid and thiamine A positive and significant relation was found between dietary vitamin intake and the vitamin content of milk for the vitamins analysed

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THE HEIGHT, WEIGHT AND SKINFOLD THICKNESS OF MUAR SCHOOL-CHILDREN

by

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and

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From time to time reference has been made in official reports to the occurrence of malnutrition in children living in the Muar Rural Health District in Malaya. However, a systematic assessment of the degree and extent of such malnutrition does not seem to have been made, and it was thought worthwhile to publish the results of a small survey

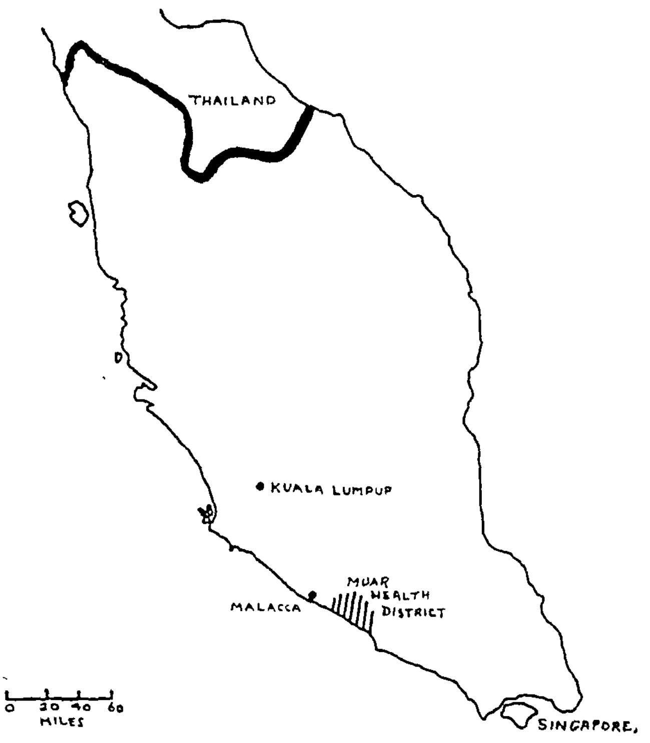

FIG. 1. Map of Malaya showing location of Muar Health Area.

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* It is a pleasure to record our indebtedness to the Medical Department, Federation of Malaya, for granting facilities for making this investigation, and to Mr. AZIZ BIN KUNTOM for his practical assistance.

undertaken in this region In the present paper the results of measuring the height, weight and skinfold thickness are given The results of a haemoglobin survey in these children are given elsewhere (WADSWORTH and LEE, 1959)

MATERIAL AND METHODS

The children studied in the present survey attended six schools situated in the Muar Rural Health District (Fig 1) Two of these schools were Chinese, the remainder were Malay Some of the parents of the children were farmers, but most of them were rubber tappers All belonged to the lower income group

The height and weight of 280 boys and 190 girls were recorded, and skinfold measurements made on 279 of the boys and 179 of the girls The ages, which were, with very few exceptions, obtained from registration records, ranged from six years to 15 years

Weighing was made on a small portable spring balance, the accuracy of which was tested against a large accurate counter-weight balance The results of these tests showed that the spring balance was reading 4 lbs too light, and all observed weighings were correspondingly corrected Children were weighed without shoes Boys wore only a light pair of short trousers, but the girls were fully dressed No allowance was made for the weight of clothing, and at the most this would add less than 3 lbs to the true weight in the older girls

Skinfold measurements were made by means of an MRC caliper using the six sites described by HAMMOND (1955) Measurements were made on the right and left side of the body, but only one abdominal site was used All measurements throughout the survey were made by the same observer

RESULTS

Height and weight Individual results are shown for height and weight in the scatter diagrams (Figs 2, 3, 4 and 5) and mean values in Table I

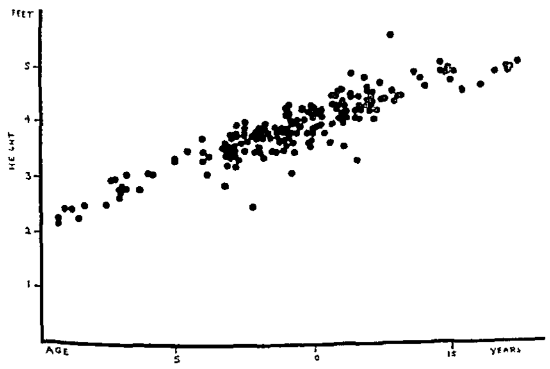

FIG 2 Heights of girls

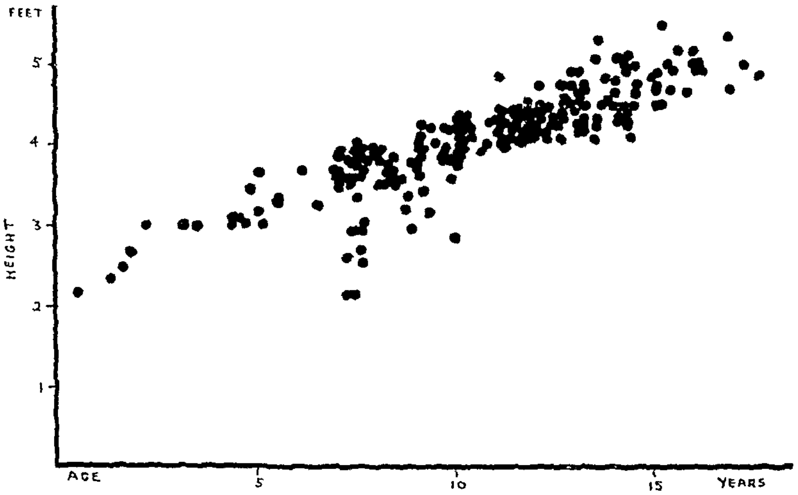

FIG. 3. Heights of boys.

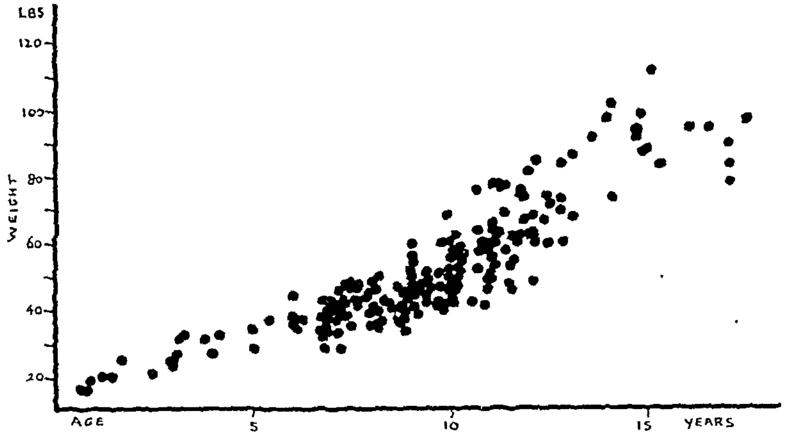

FIG. 4. Body weights of girls.

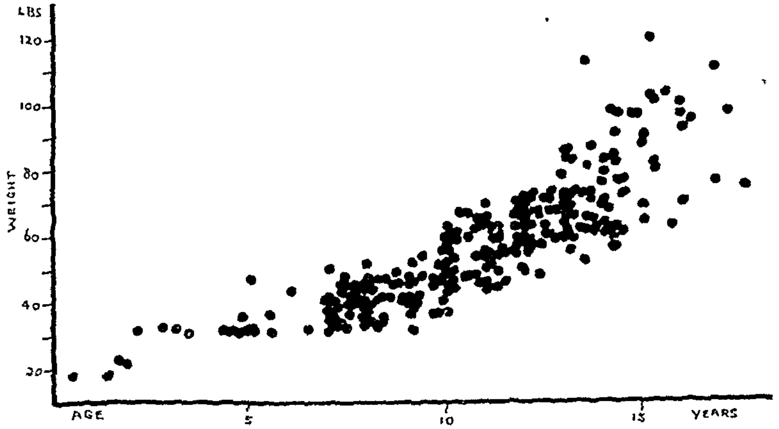

FIG. 5. Body weights of boys.

TABLE I

(a) Heights of Muar Schoolchildren

Age	Boys				Girls			
	No	Ht ins	Std Devn	Ht cms	No	Ht ins	Std Devn	Ht cms
6	—	—	—	—	15	41 5	2 06	105 4
7	43	43 2	3 15	109 7	28	43 2	2 90	109 7
8	26	44 0	3 37	111 8	25	44 4	2 28	112 8
9	28	45 0	4 18	114 3	37	46 4	3 02	117 9
10	42	48 4	0 63	121 9	33	48 6	2 27	123 4
11	40	50 9	0 58	129 3	29	51 9	3 82	131 8
12	34	52 5	2 31	133 4	14	54 0	3 74	137 2
13	30	54 5	2 55	138 4	—	—	—	—
14	22	55 7	3 37	141 5	—	—	—	—

(b) Body weight of Muar schoolchildren

Age	Boys				Girls			
	No	Mean (lbs)	Std Devn	Wt (Kg)	No	Mean (lbs)	Std Devn	Wt (Kg)
6	—	—	—	—	15	36 1	3 3	16 4
7	43	39 2	5 3	17 8	28	41 0	4 5	18 6
8	26	42 8	5 1	19 5	25	41 2	4 5	18 7
9	28	45 6	4 7	20 7	37	47 9	5 5	21 8
10	42	53 3	6 8	24 2	33	52 7	7 7	24 0
11	40	59 5	7 0	27 0	29	62 6	9 4	28 5
12	34	64 9	7 3	29 5	14	65 9	9 2	30 0
13	30	71 4	11 7	32 5	—	—	—	—
14	22	77 7	13 0	35 3	—	—	—	—

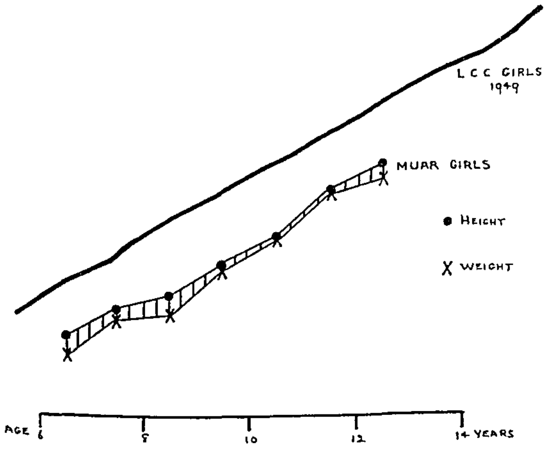

FIG 6 Mean heights in relation to mean weights of Muar girls The relative leanness of the Muar girls and boys can partly be explained by the fact that weight of London children includes their clothing

An analysis of the relationship between mean height and mean weight for the different age groups in comparison with similar measurements on London schoolchildren (LCC, 1949) is shown in Figs. 6 and 7.

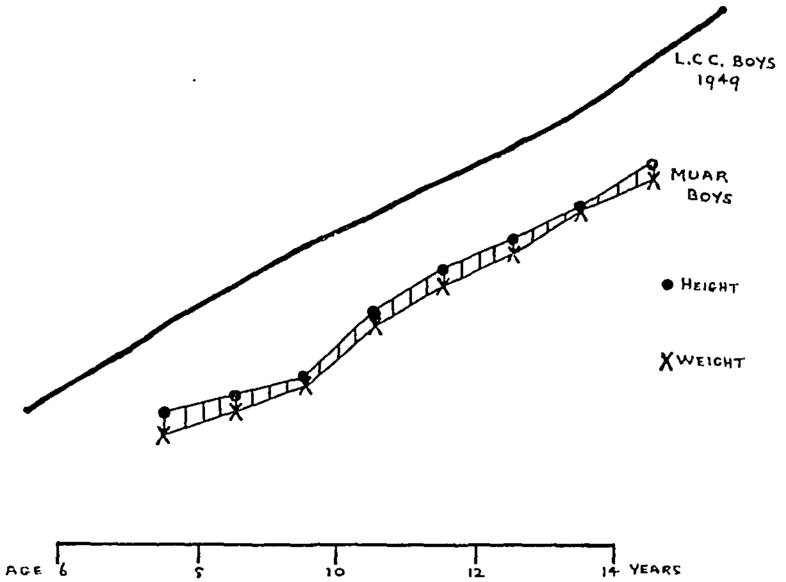

FIG. 7. Mean heights and weights of Muar boys.

This method has been in use for some years in the Applied Nutrition Unit*, London School of Hygiene and Tropical Medicine (WIGLEY, 1952) and is designed to give an immediate visual impression of the body size and degree of leanness or fatness of individuals or groups of children in comparison with an arbitrary normal standard. The present analysis showed that both the Muar girls and boys were considerably smaller and lighter for their age than London schoolchildren, but that weight for height was very much the same.

TABLE II. Skinfold thickness (in mm.) of Muar boys.

Age	No.	Biceps	S.E.	Triceps	S.E.	Sub-scap.	S.E.	Sub-cost.	S.E.	Supra-iliac	S.E.	Ab-dom.	S.E.
7	43	3.8	0.18	6.2	0.14	4.9	0.11	4.2	0.12	4.1	0.07	4.4	0.17
8	27	3.9	0.17	6.4	0.29	5.3	0.26	4.8	0.15	4.7	0.25	4.7	0.14
9	28	4.0	0.14	6.0	0.33	4.8	0.16	4.8	0.14	4.5	0.13	4.6	0.15
10	42	4.2	0.14	6.2	0.13	5.2	0.13	5.1	0.20	4.6	0.15	4.9	0.14
11	40	4.2	0.18	6.8	0.28	5.5	0.24	5.2	0.34	5.0	0.13	5.3	0.23
12	34	3.9	0.12	6.6	0.20	5.7	0.24	5.4	0.13	5.3	0.20	5.9	0.29
13	30	3.7	0.19	6.3	0.26	5.9	0.21	5.5	0.09	5.4	0.12	5.6	0.27
14	22	3.7	0.12	6.3	0.10	6.1	0.22	5.8	0.19	5.9	0.16	5.9	0.21
15	13	3.8	0.14	6.5	0.34	6.5	0.45	6.3	0.32	6.1	0.46	6.2	0.39

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* GRANT, M. W. "Technique for the analysis of height and weight data in tropical countries." 1951. Mimeograph. (Heights are plotted against a linear scale, and weights against a logarithmic scale. Height and weight points are superimposed in the case of the arbitrary normal group. When points for weight fall below those for height, this indicates relative leanness).

Skinfold thickness The mean skinfold thickness for boys and girls at different ages are shown in Tables II and III The thickness for each site is the mean of the measurement on the left and right sides of the body, except for the abdominal which was a single measurement

TABLE III Skinfold Thickness (in mm) of Muar girls

Age	No	Biceps	S E	Tri ceps	S E	Sub scap	S E	Sub-cost	S E	Supra iliac	S E	Ab dom	S E
6	15	4 0	0 16	7 0	0 48	5 6	0 34	4 7	0 32	4 7	0 34	4 7	0 40
7	27	4 1	0 22	7 3	0 18	5 7	0 25	5 0	0 19	4 8	0 22	5 0	0 27
8	25	4 3	0 20	6 2	0 76	5 5	0 39	5 3	0 22	4 7	0 11	5 1	0 26
9	37	4 6	0 23	6 8	0 27	5 4	0 24	6 0	0 28	5 2	0 18	5 3	0 26
10	34	4 5	0 24	7 1	0 26	6 1	0 35	6 0	0 20	5 5	0 20	6 1	0 47
11	27	5 2	0 25	7 0	0 29	6 0	0 36	6 4	0 22	6 0	0 29	6 2	0 44
12	14	4 8	0 35	7 9	0 56	7 6	0 53	7 4	0 62	7 3	0 56	6 7	0 58

An estimate of the weight of surface body fat was made by taking the mean skinfold thickness of all sites This was converted to true fat thickness from the regression line given by HAMMOND (1955) The mean fat thickness was then multiplied by the surface area of the body computed by means of the Dubois formula The results are shown in Table IV, which includes the mean value for all sites , corresponding values derived from HAMMOND (1955) are given for comparison

TABLE IV Mean skinfold thickness surface area and surface fat of Muar children

Age	Mean skin fold thickness Muar	Equivalent fat thickness	Mean skinfold thickness England (Hammond 1955)	Surface Area	Fat	Fat %age Body wt
Boys	mm	mm	mm	sq m	Kg	
7	4 60	4 05	4 80	0 736	2 98	16 7
8	4 97	4 40	4 81	0 776	3 42	17 5
9	4 78	4 20	5 43	0 809	3 40	16 4
10	5 03	4 50	5 41	0 906	4 08	16 7
11	5 33	4 85	5 88	0 990	4 80	17 7
12	5 47	5 00	5 70	1 052	5 26	17 8
13	5 40	4 95	5 64	1 126	5 56	17 2
14	5 62	5 20	5 68	1 184	5 90	18 1
Girls						
6	5 12	4 6	6 37	0 691	3 17	19 3
7	5 32	4 85	6 27	0 750	3 63	19 5
8	5 18	4 7	6 88	0 767	3 60	19 2
9	5 55	5 15	7 11	0 845	4 35	19 9
10	5 88	5 45	7 33	0 910	4 96	20 3
11	6 13	5 75	8 18	1 027	5 90	20 3
12	6 95	6 60	7 98	1 081	7 14	23 8

DISCUSSION

It is well known that the quantity or quality of the diet may seriously affect growth and in the absence of obvious clinical signs of malnutrition, growth of children provides one of the best objective means of assessing nutritional status There is ample evidence, for example, contained in successive annual reports of Public Health Authorities in England, that improved conditions of life have been associated with a corresponding increase in the height and weight of children. The question now arises of the optimal height and weight of children at different chronological age, and whether under present conditions an increasing number of children are excessively heavy. For this reason alone it cannot be assumed that average heights and weights for London children represent ideal parameters by which to judge normality of other groups of children. However, such a standard is bound to be an arbitrary one and it is better to adopt one standard for comparison than none at all. Another factor of importance is the influence of race and other genetic influences on body size and physique. Only when such influences are excluded can child growth be used as a simple index of nutritional status. This question remains unresolved, although there is evidence that environmental factors may be more important than racial ones (GREULICH, 1958). The present observations show that schoolchildren in Muar are smaller than English children of the same age. The Malayan children had been born during the latter part of the war and during the state of " emergency." Both circumstances might have added to the difficulties of obtaining sufficient food. In addition these children take part in the rubber-tapping duties of their parents, and also have to walk many miles each day between their home, rubber estate and school. Their caloric requirements are therefore probably greater than those of English children.

During childhood body fat represents 22 to 28 per cent. of the body weight (HUNT and GILES, 1956 ; MACIE and KELLY, 1957). Surface fat probably represents only 95 per cent. of the total body fat in adult men (BROZEK and KEYS, 1951). If this proportionate distribution applies to children the present measurements show that these Malayan children were not unduly thin, and this is in agreement with the height/weight relationship (Fig. 6 and 7).

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HEALTH SURVEY OF CHILDREN FROM RAROTONGA, COOK ISLANDS

II. CLINICAL TESTS

by

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A previous article in this series (FRY, 1959) presented the results of a medical examination of 159-162 Polynesian children aged 5 to 16 years from the island of Rarotonga, Cook Islands, South Pacific. Background data on these children and the environment they live in were reported in that article. As a part of the medical examinations given to these children, tests were made of their reaction to tuberculin using the Mantoux test, and of their blood pressure, temperature, and pulse and respiration rates. These data are presented in this, the second article of the series.

Mantoux Test. An age difference was evident on the Mantoux test. All children 12 years of age or older showed a positive reaction to the test, as compared with only 71 per cent of those under 12 years. The age, number and percentage of reactors and non-reactors are shown in Table I.

TABLE I. Rarotongan Mantoux Reactions

Age	Non reactors	Reactors	Total	% Reactors
5	1	1	2	50
6	10	9	19	47
7	8	10	18	56
8	5	6	11	54
9	3	15	18	83
10	0	17	17	100
11	1	11	12	92
12	0	12	12	100
13	0	18	18	100
14	0	19	19	100
15	0	11	11	100
16	0	4	4	100
Total	28	133	161	$\bar{x} = 83$

A X^2 test was equal to 0.04, thus, there are no significant differences between the boys and girls on this test.

The 133 Rarotongan children with positive Mantoux reactions are those who have been exposed to tuberculosis bacilli. The incidence of clinical tuberculosis in this group can only be established by x-ray examination and sputum cultures, but it is probably high. The results from the Titikaveka children are similar to those reported by LAMBERT (1926), who tested 113 children 5 to 19 years of age from Arorangi village on Rarotonga. Lambert found that 86 per cent of these children were positive reactors.

Twenty-five years later, FAINE and HERCUS (1951) found only 46 per cent reactors when they tested 128 children 8 to 19 years of age from Arorangi village. Moreover,

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they found only 8 radiologically suspect cases from a total sample of 365 Rarotongans. These authors believe that the incidence of tuberculosis in the Cook Islands is about 22 per 1,000.

If we assume that one-half of the previously reported 10 subjects with chest infections are tubercular, then the incidence for this population is 30 per 1,000. This figure is quite close to the figure of 22 per 1,000 reported by FAINE and HERCUS.

The Tuberculosis Control Division of the United States Public Health Service reports that there is 1 death from tuberculosis for every 9 clinically observable cases (ARONSON, 1948). When this ratio is applied to the incidence of tuberculosis-caused deaths in the Cook Islands — 450.0 per 100,000 — the resulting incidence of morbidity is 40 per 1,000.

It seems likely, therefore, that the true incidence of tuberculosis in the Cook Islands lies somewhere between the 22 per 1,000 reported by FAINE and HERCUS, and the 40 per 1,000 mentioned above.

Blood Pressure. The systolic and diastolic blood pressures of the Rarotongans were compared to similar data gathered in a longitudinal study by GRAHAM, HINES and GAGE (1945). Their standards were determined by measuring 3,580 White children from Minnesota schools. The blood pressure differences between the averages for the Minnesota boys and girls were less than 1 mm., hence their standards were reported with the sexes combined. The systolic and diastolic blood pressures of the Rarotongans and the Minnesotans are listed in Table II.

TABLE II. Systolic and Diastolic Blood Pressures in Rarotonga and Minnesota Children.

	Systolic			Disatolic		
Age	Rarotonga		Minnesota Boys & Girls	Rarotonga		Minnesota Boys & Girls
	Boys	Girls		Boys	Girls	
5	x	100.0	93.9	x	67.0	54.9
6	100.8	97.8	100.0	59.5	63.1	55.5
7	103.6	108.3	102.2	62.5	74.3	55.8
8	108.6	102.8	104.7	74.0	72.0	56.5
9	106.6	106.4	106.5	66.3	63.4	57.0
10	113.7	113.1	108.6	67.4	77.1	57.7
11	115.1	118.3	110.9	77.4	79.1	58.5
12	109.2	119.4	112.7	68.0	76.8	59.0
13	118.8	121.2	115.2	74.0	73.1	59.6
14	115.3	122.2	117.9	74.0	81.2	60.5
15	118.6	121.0	120.8	73.7	72.0	60.8
16	121.5	x	121.4	83.0	x	61.1

GRAHAM, HINES and GAGE found no sex differences for their group, but the Rarotongan girls average 2 mm. higher than the boys in systolic blood pressure, and 3.5 mm. higher in diastolic blood pressure. All groups show a trend to rising systolic and diastolic blood pressures with increasing age. The systolic pressures usually increase at a faster rate than the diastolic pressures.

The significance of the differences between the Rarotongans and the Minnesotans was tested by the use of standard scores. No significant differences were found for systolic blood pressure for either sex of Rarongans. The Polynesians, therefore, do not differ significantly from American White children in systolic blood pressure.

Significant differences do appear for diastolic blood pressure, however These may be seen in Table III

TABLE III Standard Score Differences Between Minnesotans and Rarotongans on Daistolic Blood, Pressures

Age	Boys	Girls
5	x	2 79**
6	0 99	1 88
7	1 68	4 62**
8	3 69**	3 27**
9	1 97*	1 35
10	2 04*	4 08**
11	3 79**	4 12**
12	1 62	3 60**
13	2 96**	2 77**
14	2 60**	3 99**
15	2 51*	2 18*
16	4 22**	x

* Significant at the 5% level
** Significant at the 1% level

In most cases there is a significant difference between the Rarotongans and the Minnesotans Diastolic blood pressure is significantly higher in the Rarotongans than in the Minnesotans

The significantly higher diastolic blood pressures of the Rarotongans are difficult to explain Since the systolic pressures were normal, these high readings are not indicative of hypertension, nor do they result from anxiety about the examinations It is possible, however, that these readings are a result of chronic infections, particularly of tuberculosis, which appears to have a high incidence in this population However, the values which GRAHAM, HINES and GAGE (1945) have reported as standard, tend to be lower than the standards of others (RICHEY, 1931 , DOWNING, 1947 , PICKERING, 1955), hence the Rarotongan values may only seem high, whereas in reality they are normal

Pulse, Respiration and Temperature Comparative information on the pulse rate, respiration rate and body temperature of the Rarotongans has been taken from a longitudinal study by ILIFF and LEE (1952) Their study is based on a sample of White children

TABLE IV Rarotongan and Denver Pulse Rates

Age	Rarotonga		Denver	
	Boys	Girls	Boys	Girls
5	x	86 0	x	81 5
6	86 7	91 6	77 5	78 0
7	88 8	76 7	75 5	76 5
8	80 0	88 8	74 0	74 5
9	80 7	82 5	71 5	71 5
10	76 0	81 2	68 5	69 5
11	67 2	80 0	67 0	69 0
12	73 1	79 4	66 5	69 0
13	70 2	69 5	65 5	68 5
14	74 3	73 3	63 5	67 0
15	74 0	73 3	61 5	65 5
16	70 0	x	61 0	x

from the Denver growth study. Determinations of body temperature and pulse and respiration rates were made on 102 boys and 95 girls under basal conditions. The data for the Denver study were reported in terms of means and standard deviations in one year age groups, using the half year interval as the mid-point. For comparative purposes, these were revised into yearly intervals with the year as the mid-point.

The pulse rates of the Rarotongans and Denver children are shown in Table IV.

The Rarotongans tend to have higher values than the Denver children, but none of the differences between the two groups are statistically significant. Both groups show a decline of pulse rate from younger to older ages.

The respiration rates of the Rarotongans and the Denver children to whom they are compared are shown in Table V.

TABLE V. Rarotongan and Denver Respiration Rates.

Age	Rarotonga		Denver	
	Boys	Girls	Boys	Girls
5	x	22.0	x	21.5
6	22.4	21.4	21.5	21.0
7	19.4	22.7	20.5	20.5
8	21.2	26.4	20.0	20.0
9	20.1	23.3	19.5	19.5
10	20.0	22.0	19.0	19.0
11	21.6	20.0	19.0	19.0
12	20.0	18.3	19.0	19.0
13	20.4	19.9	19.0	18.5
14	19.2	20.7	18.5	18.0
15	18.0	18.0	17.5	18.0
16	21.2	x	17.0	x

Most of the Rarotongan respiration rates are higher than those of American Whites, although only one significant value was found. This occurred at 8 years for the Rarotongan girls, when Z = 3.20, significant at the 1 per cent level. In general, then, the Rarotongans are not significantly different from American Whites with regard to respiration rate.

TABLE VI. Rarotongan and Denver Oral Temperatures.

Age	Boys			Girls		
	Rarotonga	Denver	Sig. Diff.	Rarotonga	Denver	Sig. Diff.
5	x	x	x	99.0	98.5	ns
6	99.1	98.4	ns	99.3	98.5	5%
7	99.2	98.4	5%	99.4	98.4	5%
8	99.3	98.3	5%	99.5	98.4	1%
9	98.9	98.2	ns	99.2	98.2	5%
10	99.2	98.0	5%	99.3	98.2	1%
11	99.2	98.0	1%	98.9	98.0	5%
12	99.3	97.9	1%	99.0	98.0	5%
13	98.9	97.8	1%	99.0	97.9	5%
14	99.0	97.6	1%	99.0	97.9	5%
15	99.1	97.5	1%	98.9	97.9	5%
16	99.2	97.4	1%	x	x	x

5% Significant at the 5% level.
1% Significant at the 1% level.
ns Not significant.

A number of significant differences are apparent when the body temperatures of the Rarotongans are compared to those of the Denver sample These are shown in Table VI.

For the Rarotongan boys, 9 out of 11 ratings are significantly higher either at the 5 per cent or 1 per cent level. The Rarotongan girls also have higher body temperatures, with significant ratings at the 5 per cent or 1 per cent level occurring 10 out of 11 times.

The Denver Whites show a slow but steady fall of body temperatures from childhood to adolescence. Such a trend is not apparent for the Rarotongans, although the girls do show a decrease of values after 8 years.

We cannot determine the exact cause of high body temperatures in the Rarotongans, but climate, race and disease may be causative factors It will be remembered that most of the Rarotongans are positive Mantoux reactors ; a number suffer from skin diseases of various types ; and, many of them undoubtedly carry a heavy load of intestinal parasites It is likely, therefore, that the high body temperatures of the Rarotongans in addition to their high diastolic blood pressures, may result from chronic infections

SUMMARY

The most prominent and distressing feature of Rarotongan child health is the large percentage of positive reactors to the Mantoux test for tuberculosis The incidence of morbidity of tuberculosis is high for these children, approximating 22 to 40 per 1,000 The relationship between this high incidence of tuberculosis and growth is not clear. POTTHOFF (1939), who studied 441 tubercular children aged 2 to 15 years of age, found that they did not differ from non-tubercular children in stature, weight and chest dimensions In the light of these findings, therefore, it is possible that tuberculosis has not had a deleterious e[illegible] ans were not significantly different from a control group c[illegible], were significantly higher It is believed that these sig- n[illegible] from chronic infections particularly tuberculosis

The pulse and respiration rates of the Raroton[illegible] those of Denver children who were used as standards Body temp[illegible] her in the Rarotongans. These higher body temperatures may be a result of chronic infections.

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African Child Health

This Section of the Journal is devoted entirely to papers dealing with the health and welfare of the African Child.

SERUM COPPER, IRON AND IRON BINDING CAPACITY IN KWASHIORKOR

by
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Anaemia is a common, but not an invariable finding in kwashiorkor. (TROWELL, DAVIES and DEAN, 1954). Although the anaemia is not usually of the microcytic, hypochromic variety, iron therapy appears to be beneficial when given in combination with high protein diet (TROWELL and SIMPKISS, 1957). Until recently very little information was available about iron metabolism in kwashiorkor and the therapeutic use of iron has been empirical. In pigs, protein deficiency was found to cause a slight fall in plasma iron and a large fall in the total iron binding capacity (CARTWRIGHT and WINTROBE, 1948). LAHEY et al in a recent study of malnourished Mexican children reported a fall in serum copper, iron and iron binding capacity in kwashiorkor. (LAHEY et al 1958). In the present communication, we report the results of similar observations on malnourished Nigerian children.

MATERIALS AND METHODS

The subjects include 150 new cases of kwashiorkor attending the Paediatric Clinic at University College Hospital, Ibadan, between March and December, 1958. They all showed the usual typical features of kwashiorkor namely oedema, growth retardation, muscle wasting and hypoproteinaemia and most of them had skin and hair changes. Protein estimations were done on all the patients, but serum copper, serum iron and iron binding capacity were determined in 30, 35 and 31 cases respectively.

For normal controls blood was obtained over a period of months from four hundred children between 6 months and 5 years old by femoral vein puncture. Protein analyses were undertaken on all the samples, and serum copper, iron and iron binding capacity were estimated on 25, 37 and 37 children respectively. Blood was also collected from 400 adults and of these serum copper was estimated on 45 samples, serum iron on 48 samples and total iron binding capacity on 30 samples. This is part of a scheme to establish biochemical normals in Nigerians.

The serum was separated by centrifugation and assayed on the same day, but when samples could not be processed on the day of collection they were stored in the refrigerator at 4°C., and analysed the next day.

The method of MARRACK (1956) was used for assay of serum iron. For assay of iron binding capacity the serum was treated in the manner recommended by RAMSAY (1957) and the iron was determined by the method of MARRACK.

Serum copper was determined by the diethyldithiocarbamate method of EDEN and GREEN after the copper was liberated with 6 N HCl according to the technique recommended by VENTURA and KING (1951). It should be recorded here that we often found difficulty in precipitating the serum proteins in the kwashiorkor samples with 20 per cent trichloracetic acid but a clean supernatant was obtained by heating to boiling point. No difficulty was experienced with normal sera.

Total serum protein was measured by the Biuret method of WOLFSON et al, (1948). The protein fractions were determined after paper electrophoresis according to the procedure of FLYNN and DE MAYO (1951) by staining with azocarmine B and scanning with the "chromograph" and automatic reflectance densitometer marketed by JOYCE, LOEBL and Co., Newcastle, England. The protein fractions were computed as percentages of the total protein by dividing the area under each peak by the total area. By applying

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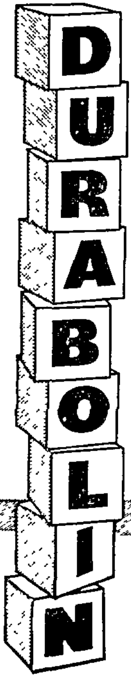

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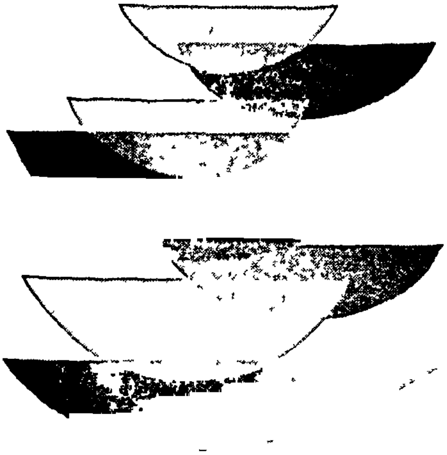

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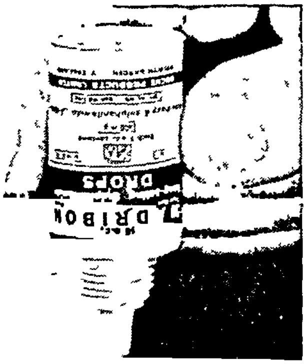

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RESULTS

Mean values with standard deviations for serum copper, iron and iron binding capacity in healthy children and in kwashiorkor are presented in Table I

TABLE I Serum Copper, Iron and Iron binding Capacity in Healthy Children and in Kwashiorkor

	Normal			Kwashiorkor			
	No	Mean	S D	No	Mean	S D	% of Normal Mean Value
Copper µg /100 ml	25	180 0	47 0	30	86 3	23 3	47 9
Iron µg /100 ml	37	62 7	17 0	35	40 6	21 5	64 7
Iron binding Capacity µg /100 ml	37	273 0	59 0	31	119 3	54 5	43 7
% Saturation of Iron binding Capacity		23 0	6 6		49 0	25 0	213 0

The serum copper concentration is higher in normal Nigerian children than in healthy adult Nigerians The mean value for 45 adult Nigerians was 126 5 ± 24 0 µg/100ml , a figure which is very close to the mean value quoted in Europeans for the method and to the values found in adult Europeans living at Ibadan In the children the values are highest in the first year of life and gradually decline with increase in age In comparing the results in health with those of kwashiorkor patients, it is essential therefore, to make comparisons within narrow age limits , we have included only children between 1 and 3 years of age

Serum iron and iron binding capacity did not show any definite trend with age, but values in children are generally lower than in adults Mean value for serum iron in 48 adult male Nigerians was 101 0 ± µg /100 ml and mean value for total iron binding capacity in 30 adult males was 385 0 ± 72 0 µg /100 ml

In kwashiorkor serum copper is reduced to 47 9 per cent of normal ($p <$ 001), serum iron to 64 7 per cent of normal ($p <$ 001) and siderophilin to 43 7 per cent of normal ($p <$ 001) The percentage saturation of the total iron binding capacity was increased by 113 per cent because the serum iron was reduced to a lesser degree than the total iron binding capacity Some of the patients exhibited very low values for serum iron , in 2 cases out of 35 examined no iron was detectable in the serum and 7 had values less than 20 µg /100 ml In the kwashiorkor patients the percentage saturation of the total iron binding capacity also varied very widely from 8 per cent to 100 per cent, though it was generally above the normal range ✓

Values for total serum proteins and the protein fractions in normal children and in cases of kwashiorkor are given in Table II The greatest changes in kwashiorkor are in the albumin and β globulin fractions which are reduced to below 50 per cent of normal , the α_2 fraction shows a variable decrease while the changes in α_1 globulin and in γ globulin are not significant

DISCUSSION

The changes in serum protein in kwashiorkor have not been adequately described. Although the literature on the subject is quite considerable (ANDERSON and ALTMAN, 1951, CLOSE, 1953, GOMEZ et al, 1955, SCRIMSHAW et al, 1955, CARR and GELFAND, 1957, PATEL et al, 1958), much of the published work suffers from two serious criticisms. Firstly the values found in Africans and others of mixed race are often compared with values for Europeans. It is now well established that the serum protein pattern in Africans and other populations of African descent differ significantly from the pattern in Europeans (HOLMES et al, 1951, ARENS and BROCK, 1954, GARROW, 1954, EDOZIEN, 1957, VERA and ROCHE, 1956, RAWNSLEY et al, 1956). Secondly, values for young children 1-2½ years old suffering from kwashiorkor are often compared with the values for healthy controls who are much older, often in the age group 5-10 years or in some cases with values in adults. This is because it is not always possible or convenient to obtain blood samples from younger children. Important changes in the serum protein pattern are now known to take place during the first five years of life (HOMOLKA and MYDLIL, 1955, JOSEPHSON and GYLLENSWARD, 1956, OBERMEN et al, 1956). For valid comparisons to be made results must be matched within very narrow age limits with those of healthy children of the same race and living in the same environment. We have done this in our studies of healthy Nigerian children and in Nigerian infants with kwashiorkor. We find that the most severe alterations in kwashiorkor are in the albumin and β globulin fractions. No significant change occurs in α_1 globulin; α_2 globulin is invariably lower than normal but the amount of change varies with the age of the child. In young children who normally have a high α_2 globulin the fall is almost as pronounced as that in β globulin. In older children who normally show lower mean values for α_2 globulin, the fall in the α_2 fraction is not so marked. The significance of this variation in the amount of change in α_2 globulin is not known. The serum gamma globulin shows much variation in kwashiorkor but in the majority of cases it lies within the range for normal children.

Copper is transported in the serum with the α_2 globulin (HOLMBERG and LAURELL, 1948). LAHEY et al, (1953) have found close correlation between α- globulin and the concentration of copper in the serum of the normal subject and in patients with hypercupraemia. In their kwashiorkor studies, however, no such correlation was obtained. (LAHEY et al, 1958). In our series, we have found as much correlation with kwashiorkor sera as we obtained in the sera of healthy children (Fig. 1).

Iron is carried in the serum as a β globulin complex (SCHADE and CAROLINE, 1946). We have found close correlation between the total iron binding capacity and β globulin in healthy children and in the cases of kwashiorkor (Fig. 2).

The changes in serum copper and total iron binding capacity in kwashiorkor thus follow very closely the changes in the α_2 globulin and β globulin respectively, and we agree with the conclusions of LAHEY et al, that these changes are probably secondary to changes in serum protein due to inadequate protein intake.

The low serum iron, however, cannot be the direct result of changes in the serum proteins since the total iron binding capacity is not usually completely saturated. It may be due to concomitant deficiency of iron in the diets. On the other hand, it may be the result of defective absorption or of impaired storage capacity. Profound structual changes are known to take place in the tissues in kwashiorkor as a result of loss in cell substance : liver and muscle proteins as well as most serum and tissue enzymes are greatly diminished. It is possible, therefore, that there may be a decrease in the amount of apoferritin in the intestinal mucosa with the result that iron absorption is impaired. Similar

Serum copper and serum α_2-globulin in healthy children and in cases of Kwashiorkor

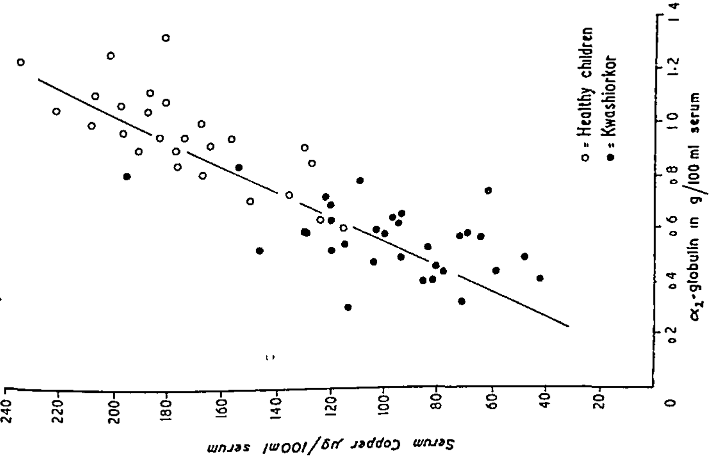

FIG. 1

Iron binding capacity and serum β-globulin in healthy children and in cases of Kwashiorkor.

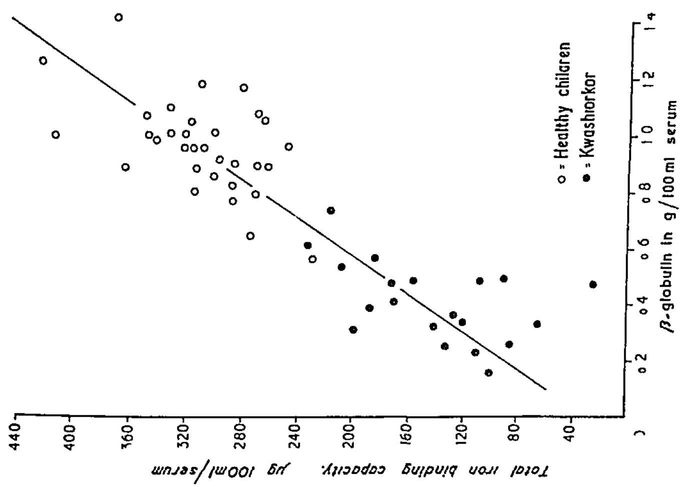

FIG 2

TABLE II. Serum Proteins in healthy Nigerian Children and in cases of Kwashiorkor.
(All Protein values expressed in g./100 ml. serum.

	12-18 months of age			1½-2½ years of age			2½-3½ years of age			3½-4½ years of age			4½-5½ years of age		
	Normal (58)	Kwashiorkor (7)		Normal (75)	Kwashiorkor (39)		Normal (44)	Kwashiorkor (47)		Normal (28)	Kwashiorkor (27)		Normal (26)	Kwashiorkor (15)	
			% of normal			% of normal			% of normal			% of normal			of % normal
Total —protein	6.9±0.5	4.0±0.4	58.0	6.9±0.5	4.1±0.5	59.4	6.5±0.6	4.1±0.6	63.0	6.7±0.6	3.9±0.6	58.2	6.5±0.6	3.9±0.5	60.0
Albumin	3.2±0.4	1.3±0.2	40.6	3.2±0.4	1.3±0.4	40.6	2.9±0.5	1.2±0.4	41.4	2.9±0.5	1.0±0.4	34.5	2.9±0.5	1.1±0.4	37.9
α_1 Globulin	0.3±0.1	0.3±0.1	100.0	0.3±0.1	0.3±0.1	100.0	0.3±0.1	0.3±0.1	100.0	0.3±0.1	0.3±0.1	100.0	0.3±0.1	0.3±0.1	100.0
α_2 Globulin	1.0±0.2	0.5±0.2	50.0	0.9±0.2	0.5±0.2	55.6	0.8±0.2	0.5±0.2	62.5	0.8±0.2	0.5±0.1	62.5	0.7±0.1	0.5±0.2	71.4
β Globulin	0.9±0.2	0.3±0.1	33.3	0.9±0.2	0.4±0.2	44.4	0.8±0.2	0.4±0.1	50.0	0.9±0.2	0.4±0.1	44.4	0.8±0.2	0.4±0.2	50.0
γ Globulin	1.5±0.3	1.6±0.4	106.7	1.6±0.3	1.6±0.5	100.0	1.7±0.4	1.7±0.5	100.0	1.8±0.4	1.7±0.6	94.4	1.8±0.5	1.6±0.4	88.9

reduction of apoferritin in the liver and other tissues will diminish the storage capacity of the body for iron.

The low serum iron indicates that the body stores of iron are low and this provides theoretical justification for the use of iron preparations in the treatment of kwashiorkor.

SUMMARY

Changes in serum protein, copper, iron and iron binding capacity in kwashiorkor have been studied. Fall in the concentration of copper and of total iron binding capacity follow closely the changes in α_2 globulin and β globulin respectively and are probably secondary to changes in the serum proteins as a result of inadequate protein intake. It is concluded that the low serum iron is the result either of dietary iron deficiency or of disturbance of iron absorption and iron storage.

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EDITORIAL

FAILURE OF LACTATION IN THE TROPICAL ENVIRONMENT

Breast-feeding is customary and almost universally successful amongst less sophisticated tropical peasant mothers. Its importance is shown by the customary excellent growth during the first six months of life and the usual absence of protein-calorie malnutrition in the first year of life. The protein content of breast-milk from these poorly-fed mothers is now well-recognized to be normal, even in late lactation, while the amino-acid composition of milk from African mothers has been shown to be within the same range as for well-fed Caucasians. The yield in late lactation is small, but not insignificant, for example, Gopalan has found that mothers in South India were producing some 12 oz. daily between the 18th and 24th months of lactation (1).

Prolonged breast-feeding, possibly up to two years of age, is to be recommended for most tropical infants. For the first six months of life, breast milk alone usually constitutes a complete food for the growing infant, at about six months and subsequently as wide a range as possible of easily digestible foods, especially animal and vegetable protein foods, should be introduced into the diet, while the relatively small amount of breast milk can be considered as a small, but important, supplement of animal protein.

The satisfactory situation with regard to prolonged lactation obtaining among poor tropical communities must be considered a most valuable asset, to be preserved, protected, and, if possible, augmented. With the latter in mind, investigations have been carried out in India to determine the effect of locally traditional galactogogues and of protein supplementation with skimmed milk on the output of breast milk in various stages of lactation in poorly nourished Indian women. Preliminary findings showed no increase in yield, although the desirable effect of additional protein intake on the pregnant woman's nitrogen balance has shown by the same group of workers.(1)

Despite the prophylactic importance of breast-feeding, prolonged up to about two years in most lower socio-economic groups in the tropics, there is mounting evidence that the falling off breast-feeding which appears to have swept across the Western world in the last fifty years is also occurring in the tropics among the well-to-do and even, to a lesser, but increasing, extent, among the less privileged poor mothers. As noted by Welbourn in East Africa in a paper aptly titled " Bottle feeding : a problem of modern civilization," the effect of this trend in tropical countries with completely inadequate supplies of animal milk, poor standards of hygiene and low levels of maternal education can only be disastrous.(2) One of the basic aims of nutritional policy in relation to the protein-calorie malnutrition in tropical regions should be based on the realization of the danger of this trend and on a consideration of methods of preventing its spread, a subject about which at present we are profoundly ignorant.

It would be extremely interesting if readers in various parts of the world could express their views on this subject, together with remarks on trends in breast-feeding in towns in their countries.

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THE NESTLE FELLOWSHIP

A fellowship of 10.000 new francs is granted every year by the French Nestlé Company to a physician who wishes to do special work in the field of nutrition.

The panel of judges of the fellowship awarded the latter to Doctor Juan Rodriguez Soriano (Barcelona) for the year 1960-1961.

The fellowship for 1961-1962 will be awarded in the Spring 1961, the candidates are requested to send the following papers to the International Children's Centre, Château de Longchamp, Bois de Boulogne. PARIS XVI° :

(a) *a Curriculum Vitae* mentioning their work on biological and social problems concerning feeding or nutrition of infants and children.
(b) *a letter of introduction* from one of their Masters,
(c) *a description of the studies* which they wish to pursue with the help of the fellowship.

The candidates must have a sufficient command of the French language.

At the end of their fellowship the fellow or fellows will be expected to remit to the International Children's Centre a scientific paper on the subject which they will have studied during the year of their fellowship.

INFANTILE GASTROENTERITIS IN A NEWBORN INFANT NURSERY IN DJAKARTA, INDONESIA

by

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Previous studies have shown that pathogenic *Escherichia coli* of the serotype 0111 B4 : H2 is an important cause of infantile diarrhoea in Djakarta (SAHAB and LIE KIAN JOE, 1958 , LIE KIAN JOE et al , 1958) This organism was found to be endemic in the newborn infant residence of the Central General Hospital in Djakarta causing a high mortality among premature infants A non-motile type 055 B5 was also isolated from a number of cases

Conditions have not changed in the newborn infant nursery and there has been no decrease in the incidence of gastroenteritis among the babies Infected babies were usually transferred to the pediatric department although this was not always possible because of the limited number of isolation rooms Many had to be nursed in the newborn infant residence in spite of the fact that they were excreting pathogenic *E coli*

The present paper deals with the epidemiological aspects of different serotypes of *E coli* in the same newborn infant residence where infantile gastro-enteritis has been endemic for a long time

METHODS OF INVESTIGATION

Methods of investigation have been described in a previous paper (SAHAB and LIE KIAN JOE, 1958) differing only that, in addition to 0111 B4 and 055 B5 sera the following nine diagnostic *E coli* OK sera were used 026 B6, 086 B7, 0114 B , 0119 B14 0125 B15 0126 B16, 0127 B8, 0128 B12 and 0142 K86(B)

Faeces were obtained from cases of diarrhoea Mild diarrhoea could remain unnoticed because of the shortage of nursing personnel , therefore faeces were also examined from babies who did not show an increase in body weight even though they were not reported to have diarrhoea Faeces were not always obtained at the onset of disease nor were they always fresh Sometimes the specimen was obtained after the baby had been suffering from diarrhoea for some time or even after institution of antibiotic therapy Whenever possible, more than one faecal specimen from each case were cultured At least 8 suspected *E coli* colonies were examined from each Drigalsky plate All faecal specimens were cultured for *Shigellae* and *Salmonellae* Healthy babies were not examined The vomit from five patients was also cultured

RESULTS

This survey was carried out over a period of six months, from August 1, 1957, until January 31, 1958

During this period the faeces of 217 babies were examined In 92 (42 per cent) of the babies pathogenic *E coli* was isolated , 43 strains being isolated from the first faecal specimen, 30 strains from the second specimen, 13 strains from the third, three strains from the fourth, two from the fifth and one from the seventh faecal specimen The faeces from 97 of the negative cases were examined once only, 19 twice and 9 three times In

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* We are greatly indebted to Dr PIERZE NICOLLE of the Pasteur Institute in Paris who kindly did the phage typing of the 0111 B4 H2 strains

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one case a strain was isolated from the vomit while the faeces were negative. Thus, a total of 93 cases were found.

A total of 1,215 babies were admitted during the period of study. Among 1,051 babies with a birth weight of 2,000 g. or more, 593 were sent home and 17 died within five days of admission. No record on the length of the stay in the hospital could be secured for 47 babies. Among the remaining 394 babies who stayed for more than 5 days, 96 contracted diarrhoea and 29 of these showed pathogenic *E. coli* in the faeces. In the group of 164 infants weighing less than 2,000 g. at birth 36 died within five days of admission and ten were taken home before 5 days among whom three had diarrhoea. Of the remaining 118 infants nursed for more than five days, 115 contracted diarrhoea, while the remaining three babies did not show increase in birth weight. Sixty three of them had pathogenic *E. coli* in their faeces. No *Shigellae* or *Salmonellae* were isolated in this survey.

The vomit of four patients who were excreting 087 : B7 : - in the faeces was examined. One specimen from each case was obtained. No pathogens were isolated. From another case type 0119 : B14 was isolated from the vomit but faecal examination of this case was negative.

Birth weight and sex. The birth weight and sex of the 93 cases are shown in Table I. The disease occurs more frequently in prematures. The total number of male infants kept in the newborn infant residence for more than 5 days during this study was 266 and that of females was 246.

TABLE I. The distribution by birth weight and sex of infants from whom pathogenic *E. coli* was isolated.

Weight in grams	Male	Female
1000-1500	6	12
1500-2000	20	26
2000-2500	9	8
2500-3000	3	2
3000-	7	—
Total	45	48

Incubation period. The incubation period is defined as the time which elapsed from the day of admission to the appearance of the first symptoms. This period was usually longer than the true incubation period which could not be determined. In addition, the onset of disease was not always clear cut. Due to the shortage of nursing personnel mild diarrhoea remained unnoticed.

The incubation period of the disease in 86 infants is shown in Table II. This varied from two to 30 days. It is believed that the group of infants born in the hospital represented nosocomial infections. Nine cases of this group developed diarrhoea within five days after birth.

The infants born outside the hospital were admitted within 24 hours after birth, with the exception of 6 cases who were admitted at the age of 2, 3, 3, 4, 4, and 26 days. Since most of them spent a short time outside the hospital, it is likely that many of them contracted the disease in the newborn infant residence. Six of them developed symptoms within five days after admission.

Mortality. Thirty-two babies died in the group of 93 cases of gastroenteritis in whom pathogenic *E. coli* was found. No autopsies could be performed and so it was not certain that gastroenteritis was the only cause of death. Thirty of the infants who died had a

TABLE II The incubation period of pathogenic *E coli* in infants born either in or outside the hospital

Incubation period (days)	Infants born in hospital	Infants born outside hospital
2	—	2
3	2	2
4	2	2
5	5	—
6	5	1
7	5	5
8	5	2
9	5	1
10	5	1
11	4	1
12	5	—
13	2	1
14	1	1
15	1	1
16	1	2
17	2	3
18	1	2
19	—	2
21	1	—
25	—	1
27	1	1
19	1	—
30	—	1
Total	54	32

birth weight of less than 2,000 g and two were between 2,000 g and 2,500 g Twelve died in the newborn infant residence and twenty in the pediatric department The outcome of the disease in 2 cases was not known, because they were taken home before recovery, both were in a poor condition The remaining 59 babies recovered completely

Of the remaining 124 cases examined from whom no pathogenic *E coli* could be isolated 20 died All fatal cases in this group had a birth weight of less than 2,000 g

Serotypes The serotypes isolated in this survey are shown in Table III

The bacteriological and serological properties of these strains have been studied in detail and will be published later (SAHAB, in preparation)

Serotype 0111 B4 was most frequently encountered and was endemic all the time Fifty two strains isolated had the antigenic structure of 0111 B4 H2 , two strains isolated in October, 1957 and in January, 1958 respectively had H27 antigen All strains of 0111 B4 H2 showed the same fermentation pattern as those previously described (SAHAB and LIE KIAN JOE, 1958) and phage typing of 44 strains performed by Dr P Nicolle in Paris showed all to be one phage type Vienne type

Non-motile type 086 B7 with a fermentation pattern almost similar to 086 B7 H34 was first isolated on August 31, 1957 It was present in the newborn infant residence until January 8, 1958 During this period it was isolated from 48 cases of diarrhoea However, it disappeared after January 8 and has not been reisolated up to the time of writing this report It was likely that all cases of infection with this type belonged to one epidemic which lasted for more than four months

Another non motile 086 B7 was isolated, differing from the other strains by being anaerogenic In addition, motile 086 B7 was isolated from three cases, all three probably belonging to one outbreak and all strains showing a fermentation pattern similar to 086 B7 H34

TABLE III. Serotypes of *E. coli* isolated in the newborn infant nursery, Djakarta.

No. cases	Serotype isolated
28	086 : B7 : -
1	086 : B7 : -, anaerogenic
1	086 : B7 : - ——> 0111 : B4 : H2 ——> 086 : B7 : H?
1	086 : B7 : H?
31	0111 : B4 : H2
1	0111 : B4 : H27
1	0111 : B4 : H27 ——> 0111 : B4 : H2
1	0111 : B4 : H2 + 086 : B7 : -
4	0111 : B4 : H2 ——> 086 : B7 : -
1	086 : B7 : + 086 : B7 : H?
9	086 : B7 : - ——> 0111 : B4 : H2
2	0127 : B8 : H6, anaerogenic
1	0127 : B8 : ?
1	0127 : B8 : H6 anaerogenic ——> 0111 : B4 : H2
1	0111 : B4 : H2 ——> 0126 : B16 : H2
1	0126 : B16 : H2 ——> 0126 : B16 : H2 + 086 : B7 : -
1	086 : B7 : - ——> 0111 : B4 : H2
1	0119 : B14 : H?, rhamnose positive (vomit)
1	0119 : B14 : H6 ——> 086 : B7 : - ——> 0111 : B4 : H2
1	086 : B7 : - ——> 0125 : B15 : H21
1	0125 : B15 : H21
1	0142 : K86(B) : H6
1	0142 : K86(B) : H6 ——> 0111 : B4 : H2
1	055 : B5 : -

Key to Table : + = isolated from the same faecal specimen.
——> = isolated in subsequent faecal examination.

Type 0127 : B8 was found in four cases which probably belonged to one epidemic ; all occurred at the end of December and beginning of January. Three strains were examined bacteriologically, all had H6 antigen with the same fermentation pattern and all were anaerogenic. The fourth strain was, unfortunately, lost.

In the first half of September two cases of infection with 0125 : B15 : H21 were found; they probably constituted one outbreak.

Type 0126 : B16 : H2 was isolated from two other cases. These cases probably had nothing to do with each other since they were separated by a time interval of more than one month.

Serotype 0119 : B14 : H6 was isolated from one case and type 0119 : B14 was isolated from the vomit of another case. The latter fermented rhamnose and had an unidentified H antigen.

Another case showed non-motile 055 : B5 with the same fermentation pattern as the strains previously described (SAHAB and LIE KIAN JOE, 1958).

Serotype 0142 : K86(B) : H6 was isolated from two cases, one in December and one in January. This is a new type (ORSKOV et al., 1959) often found in infants admitted to the pediatric department of the Central General Hospital in Djakarta.

Frequently more than one serotype were isolated from a patient (Table III). In three cases two serotypes were isolated from the same faeces. In 19 cases two and in two cases three different serotypes were found on subsequent faecal examination. In many cases infection with type 086 was followed by reinfection with 0111 and in others this sequence was reversed. These cases exemplified the frequency of reinfections among the infants in the newborn infant residence. However, not all cases of reinfection could be detected in this study, because follow-up examination could not be done on all cases.

Sensitivity to antibiotics Since November, 1956, cases of gastroenteritis were treated with either chloramphenicol, oxytetracycline or tetracycline It is interesting to compare the results of sensitivity tests carried out shortly and some time after introduction of antibiotic therapy

During 1957 a total of 115 strains of type 0111 were tested, using the Difco disc technique All strains were sensitive to chloramphenicol and chlortetracycline, 109 strains to tetracycline, three strains to streptomycin, eight strains to polymyxin B, 3 strains to penicillin and all were resistant to erythromycin In January, 1958, the resistancy pattern began to change Of 12 strains tested five were resistant to all antibiotics except to polymyxin B, the others were sensitive to chloramphenicol, chlortetracycline, and tetracycline and two were also sensitive to streptomycin In February, 1958, forty-two strains were tested and all were resistant to antibiotics except polymyxin B In March 1958 thirteen strains were sensitive to chlortetracycline, tetracycline and polymyxin B, but resistant to the other antibiotics and 39 strains were sensitive only to polymyxin B From April to August 1958, 116 strains were tested and all were resistant to chloramphenicol, chlortetracycline, tetracycline, penicillin and streptomycin , all were sensitive to polymyxin B Strains sensitive to erythromycin were found for the first time in June 1958 Testing was carried out again from January until March, 1959 All 30 strains tested were resistant to antibiotics except *polymyxin B and erythromycin*

All non-motile and motile 086 strains isolated from August 1957 to January 1958 were sentive to polymyxin B and resistant to the other antibiotics Three strains of 0127 were sensitive to chloramphenicol, chlortetracycline, tetracycline, streptomycin and polymyxin B and resistant to erythromycin and penicillin Serotype 0142 (one strain) was sensitive only to chloramphenicol and polymyxin B , serotype 0119 (2 strains) was sensitive to all antibiotics except penicillin , serotype 0125 (one strain) was resistant to all antibiotics except polymyxin B , and serotype 0126 (one strain) was sensitive only to polymyxin B

DISCUSSION

Diarrhoea is endemic in the newborn infant nursery of the Central General Hospital in Djakarta It is an important cause of death, especially among premature infants In the period of study, the average number of infants developing diarrhoea was more than one per day All but three infants with a birth weight of less than 2,000 g and staying for more than five days in the newborn infant residence developed diarrhoea With such a great chance for acquiring infection it is certain that a number of those discharged healthy from the newborn infant residence would develop diarrhoea at home In 42 per cent of the cases pathogenic *E coli* was isolated from the faeces However, it is believed that not all cases of pathogenic *E coli* infection could be detected by the methods used in this study As in shigellosis one faecal examination from each patient will not reveal all infected cases Even two or three specimens from each patient may not lead to detection of all cases It often happened that a patient was positive for pathogenic *E coli* on the first day but was negative on the second and positive again on the third or fourth day Moreover, not infrequently faecal specimens were sent in after institution of antibiotic therapy which would affect the results in case sensitive strains were causing the diarrhoea

The most common serotype isolated was 0111 B4 H2 It is generally accepted that this type is pathogenic and it is undoubtedly a main cause of endemic diarrhoea in the newborn infant residence, as was stated previously (LIE KIAN JOE et al , 1958) It is interesting to know that this type has been found in the ward since work on pathogenic *E. coli* was started in 1956, and it is still there at the time of writing this report.

When introduction of this type took place is not known. It has probably always been there since diarrhoea has been known to occur in the ward for many years. Having established itself, it will probably remain there until adequate measures are taken to stop further spread.

Non-motile type 086 : B7 was introduced into the newborn infant residence in August, 1957. An epidemic lasting for more than four months resulted and this organism was isolated from 48 infants during that period. We do not know how this type was introduced, nor why it disappeared after January 8, 1958. Its association with diarrhoea was striking and it was often isolated in pure or almost pure cultures from the faeces. We believe that this type is pathogenic.

Motile type 086 : B7 was isolated from an outbreak of three cases. This type showed a fermentation pattern similar to 086 : B7 : H34, a type which is considered pathogenic by many authors.

Type 0142 : K86(B) : H6 is a new serotype often found in Indonesia. Recent studies which will be published later have shown that this type is probably pathogenic. It may occur in epidemics.

The non-motile type 055 : B5 was found once in this survey but it has been isolated in pure or almost pure cultures from many cases of infantile diarrhoea occurring in the pediatric department. It is probably pathogenic. It has the same fermentation pattern as type 055 : B5 : H7 found in Europe.

Type 0126 : B16 : H2 isolated in this survey is identical with the type described by CHARTER and TAYLOR (1952) in England, while type 0119 : B14 : B6 is identical with the strain described by SMITH (1953). Types 0125 : B15 : H21, 0111 : B4 : H27 and 0127 : B8 : H6 have, as far as we know, not been described in other countries, these types may be pathogenic.

We can assume that endemicity of pathogenic *E. coli* in the newborn infant nursery is maintained mainly because of overcrowding and of the shortage of qualified nursing personnel. In addition, recurrent introduction of new strains plays an important role. In the period of study new strains and serotypes were known to have been introduced fourteen times, viz. the introduction of non-motile 086 : B7, 0125 : B15 : H21, 0127 : B8 : H6, 0126 : B16 : H2 twice, 0119 : B14 : H6, 0119 : B14 : H?, 0111 : B4 : H27 twice, 055 : B5 : -, 0142 : K86 : H6 twice, 086 : H7 anaerogenic, and motile 086 : B7. These were found in isolated cases or in small outbreaks with the exception of non-motile 086 : B7 which caused an epidemic lasting more than four months. It is certain that new strains of 0111 : B4 : H2 had also been introduced in the period of study. How often this occurred could not be determined since this serotype was present all the time. The different sensitivity patterns towards antibiotics not used for therapy in the ward suggested that different strains of 0111 : B4 : H2 were causing the endemic, while the appearance of erythromycin sensitive 0111 organisms in June, 1958 undoubtedly represented a newly introduced strain. On the other hand, the results of phage typing would suggest that only one strain of 0111 : B4 : H2 was involved in the endemic diarrhoea. However, this need not be so since subsequent studies have shown that the Vienne type is the most predominant type in Djakarta. The other type found in Djakarta, the Sevres type, is much less common. Therefore, the chances for the Vienne type to be introduced into the newborn infant residence is much greater than for the Sevres type.

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3	113 86	3 32*
38	125 66	4 24*
67	137 87	1 43
8 28	149 62	0 34
[illegible]	162 28	3 58*
[illegible]	174 25	0 31
[illegible]	183 62	0 45
		x

There is a marked difference in epidemiology between the different pathogenic intestinal bacteria occurring in the newborn infant nursery. From our observations type 0111 : B4 : H2 should be considered most dangerous under the conditions prevailing in the ward. Non-motile type 086 : B7 should also be considered dangerous. It caused an epidemic lasting more than 4 months. However, the other serotypes of *E. coli* which had been introduced many times into the newborn infant residence, occurred in isolated cases or caused only small epidemics. Similarly, *Shigellae* and *S. typhi* when introduced into the ward failed to establish themselves under conditions which were suitable for 0111 : B4 : H2 to become endemic. We do not know what factors caused this difference in epidemiology.

Infection with one serotype of *E. coli* confers, apparently, no immunity to reinfection with another serotype. Such reinfections occurred readily among infants in the newborn infant residence. Reinfection occurred during illness or after a period of recovery and was accompanied sometimes with a flare-up of the clinical symptoms. The clinical aspects of these cases will be published later by one of us (MAKALIWY, in preparation.)

SUMMARY

Diarrhoea is endemic in the newborn infant nursery of the Central General Hospital in Djakarta. From August, 1957 to January 31, 1958, 217 infants were examined and in 92 cases pathogenic *E. coli* was isolated from the faeces and in one case from the vomit. Serotype 0111 : B4 : H2 was most frequently found. It was endemic all the time and was the main case of diarrhoea in this ward. Non-motile type 086 : B7 was isolated from 48 cases of diarrhoea between August 31, 1957 and January 8, 1958. Other serotypes found were 0125 : B15 : H21. 0126 : B16 : H2, 0127 : B8 : H6, 0119 : B14 : H6, 0119 : B14 H?, 0142 : K86(B) : H6, 055 : B5 : -, 0111 : B4 : H27 and motile 086 : B7. They occurred in small epidemics or in isolated cases. Antibiotic therapy was followed by the appearance of resistant strains. Infection with one serotype was often followed by reinfection with another serotype.

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HEALTH SURVEY OF CHILDREN FROM RAROTONGA, COOK ISLANDS

III SKELETAL AGE AND SKELETAL OBSERVATIONS

by

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The results of a medical examination and background data on the children in this study were presented in the first article of this series (E I FRY, 1959a) Information on clinical tests of the health of the subjects was given in the second article (E I FRY, 1959b) The subjects were 164 Polynesian school children aged 5 to 16 years from the village of Titikaveka on the island of Rarotonga, Cook Islands, South Pacific A part of the medical examinations given to these children was an x-ray of their hand and wrist in order to determine their skeletal age This article will deal with these skeletal age determinations and observations on the presence or absence of skeletal anomalies revealed in the x-rays

SKELETAL AGE

X-ray photographs of the right wrist and hand were taken on 164 boys and girls in the Titikaveka school The exposures were made at 60 Kvp and 15 MA for one-half second (7 5 MAS) The plate to tube distance was 30 inches, the maximum for that particular machine All x-rays were made in the Rarotongan Hospital by the Cook Island x-ray technologist, MR LOUIS MARSTERS Skeletal age was determined by comparing the films with the standards given in the atlas of GREULICH and PYLE (1950) The skeletal age estimates of the author are compared to those of GREULICH and PYLE for the group of Cleveland children who form the standard in Table I

TABLE I Rarotonga and Cleveland skeletal age (months)

Age	Boys				Girls			
	N	Rarotonga (months)	Cleveland (months)	t	N	Rarotonga (months)	Cleveland (months)	t
5	x	x	x	x	2	76 50	66 21	1 24
6	8	70 80	75 46	1 45	13	69 92	78 50	2 85*
7	12	68 40	88 20	6 83*	6	78 71	89 30	2 84*
8	6	78 00	101 38	6 72*	5	85 50	100 66	2 94*
9	8	98 40	113 90	3 75*	11	102 18	113 86	3 32*
10	8	106 80	125 68	4 98*	9	111 38	125 66	4 24*
11	5	136 80	137 32	0 11	7	130 67	137 87	1 43
12	6	144 00	148 82	1 15	7	148 28	149 62	0 34
13	10	144 00	158 39	3 89*	8	148 44	162 28	3 58*
14	10	158 40	170 02	3 80*	7	173 00	174 25	0 31
15	7	174 00	182 72	1 82	4	180 00	183 62	0 45
16	5	186 00	195 32	1 38	x	x	x	x
Total	85				79			

* Significant at the 1 per cent level

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For the boys, significant retarded skeletal ages as measured by the "t" test occur at 7 to 10 and 13 to 14 years. A similar picture is seen for the girls, with significant retarded values occurring at 6 to 10 years and at 13 years of age. One striking feature which occurs for both sexes is the failure to gain in skeletal age from 12 to 13 years of age.

Greulich and Pyle referring to the skeletal variability of their standard group, have said :

" It is probably safe to assume that one standard deviation (as listed in the tables) above and below the skeletal age corresponding to the child's chronological age will include approximately two-thirds of the White children in this country who are adequately nourished and in good health ; that two standard deviations will include about 90 per cent. of all such children, in addition to some whose skeletal development is retarded as the result of disease or nutritional inadequacy ; and that a difference of more than two standard deviations above or below the mean would make it highly probable that the child is abnormally advanced or retarded." (Greulich and Pyle, 1950, p. 33).

The Rarotongan data were analyzed using the ±2 standard deviation limits of these authors. Each individual was classed as belonging either within or without these limits. The results of these calculations are seen in Table II.

Table II. Deviations of Rarotongan children in terms of skeletal age.

Age	Boys				Girls			
	N	±2	>−2	>+2	N	±2	>−2	>+2
5	—	—	—	—	2	2	0	0
6	8	4	4	0	13	11	2	0
7	12	8	4	0	6	4	2	0
8	6	5	1	0	5	5	0	0
9	8	5	3	0	11	9	2	0
10	8	6	1	1	9	7	2	0
11	5	5	0	0	7	6	1	0
12	6	4	1	1	7	7	0	0
13	10	6	4	0	8	5	3	0
14	10	8	2	0	7	6	0	1
15	7	6	1	0	4	3	0	1
16	5	4	1	0	—	—	—	—
Total	85	61	22	2	79	65	12	2

It can be seen that 82 per cent. of the girls and 72 per cent. of the boys are within the ±2 standard deviation limits of healthy American children. However, most of the children were on the retarded side of the distribution. For example, 57 per cent. of all the girls were retarded by more than 6 months, while only 18 per cent. were advanced by more than 6 months. The remaining 25 per cent. were within 6 months of the Greulich and Pyle standards for that age. Moreover, of the 14 girls and 24 boys whose skeletal ages fell outside the ±2 sigma limits 83 per cent. of the girls and 91 per cent. of the boys were retarded skeletally.

The Rarotongan data, then, when analyzed on an individual and group basis, show that the Rarotongans are retarded in skeletal age.

The cause of these findings can be explained as follows :

(i) Recent work by Acheson, Hewitt, Westropp and Macintyre (1956) and Driezen, Snodgrasse, Webb-Peploe and Spies (1957) has shown that inadequate nutrition may result in marked skeletal retardation. Driezen, Snodgrasse, Webb-Peploe and Spies found that 118 Birmingham, Alabama White children aged 16 to 18 years had skeletal ages which lagged behind those of the GREULICH and PYLE Atlas by an average of 13 55 months for the boys, and 12 07 months for the girls For the Rarotongans, the average skeletal retardation at all ages was 11 96 months for the boys, and 7 02 months for the girls P C FRY (1957a, 1957b) has shown that in early childhood, Rarotongan children receive inadequate amounts of food and are particularly lacking in calcium This nutritional inadequacy is not evident on examination, but exists on the subclinical level only

(ii) By the time the Rarotongans reach the age of 11 or 12 years, they have made up their skeletal age retardation because they get an adult's share of the food on the family table

(iii) These children again lag at about 13 years of age because they are in the midst of their pubescent growth spurt, and the nutrients which they receive are expended for this growth

(iv) After this period of rapid growth has slowed down, few of them show a lag in skeletal maturation, since nutrients are now utilized for bone growth

The Rarotongan girls are skeletally more mature than the boys except at 6 and 11 years of age The average advancement of the girls is 4 85 months Skeletal advancement of girls over boys has been well established (TANNER, 1955) and the Rarotongan data are in agreement with this general finding Calculations based on the data presented by GREULICH (1951) for children from Guam indicate that for the same age groups as represented in the Rarotongans, the girls were advanced over the boys by an average of 8 28 months At age 6, the Guamanians were similar to the Rarotongans, since the boys were ahead of the girls (0 2 months for the Guamanians, 0 9 months for the Rarotongans), but unlike the Rarotongans, the 11 year old Guamanian boys were not advanced over the 11 year old Guamanian girls

Although the Rarotongans are retarded when compared to the standards of GREULICH and PYLE, they are not as skeletally retarded as other racial groups The Rarotongans exceed GREULICH's Guamanians by an average of 1 25 years for the boys, and 0 87 years for the girls The Rarotongan boys are also advanced over West African boys (WEINER and THAMBIPILLAI, 1952) by an average of 0 86 years

TRULSON, COLLAZOS CH and HEGSTED (1956) have reported that Peruvian mestizo children showed a retardation of skeletal age compared to chronological age For the boys in their survey this retardation averaged 11 3 months, and for the girls, the average retardation was 7 1 months The Rarotongans are also not as retarded as this South American group The Rarotongan boys have an average retardation of 7 9 months, and the girls are retarded by an average of only 1 4 months

SKELETAL OBSERVATIONS

A compilation of observations made on the x-rays of these children is shown in Table III *

The cases of ulnar fracture, radial periostosis, and metacarpal thickening had presumably resulted from past trauma In the last two, there was bony thickening as a result of repair of injured tissue The short phalanx of the 5th digit and the fusion of the capitate and hamate may be genetic in origin

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* Most of these features were brought to my attention by FRANCIS J O'CONNOR, M D , chief radiologist at Augusta General Hospital, Augusta Maine

TABLE III. Features of Rarotongan Skeletal development.

Feature	No. of subjects	%
1. Lines of growth disturbance	5	3
2. Short mid-phalanx of the 5th digit	2	1
3. Disturbed tubulation		
5th digit	8	5
4th digit	2	1
3rd digit	2	1
2nd digit	2	1
Ulnar shaft	2	1
4. Bone accretion		
Proximal phalanx of 5th digit	1	1
Proximal phalanx of 4th digit	1	1
5th metacarpal	1	1
5. Fusion of capitate and hamate	1	1
6. Fracture of ulna	1	1
7. Radial periostosis	1	1
8. Metacarpal thickening from trauma	1	1

Fusion of the capitate and hamate has been reported by MINAAR (1952) who believes that this type of carpal fusion is primarily a Negroid trait. He found one case of capitate-hamate fusion among 12 cases of carpal anomalies. The total population from which his 12 cases were drawn was not given. In an earlier study, SMITHAM (1948) found 5 cases in 680 West African wrists, for an incidence of 7.4 in 1,000. BOGART (1932) in a review article of accessory carpal bones, reports on a hospital population of 1,452, presumably all from the Southern United States. He found complete capitate-hamate fusion in 3 cases, and partial fusion in another 3. This would yield an incidence of 2.1 per 1,000 for each type of fusion and an incidence of 4.2 per 1,000 for both types considered together.

The aetiology of this anomaly is unknown. MINAAR (1952) speculates that it may be an advanced feature of hand specialization, or an attempt to strengthen the ulnar border of the hand so that it can do more work with less fatigue.

The transverse lines are frequently called growth arrest lines. HERMEL, GERSHON-COHEN and JONES (1953) have shown that they are a general manifestation of disordered growth of all types, and do not result solely from growth arrest. Medical histories are not available for these children, hence the cause of these lines cannot be determined.

Disturbed tubulation was seen in 14 digits and 2 ulnar shafts from 10 individuals. Disturbed tubulation results when the diaphysis is not remodelled during growth. When tubulation has failed to occur, resorption has not taken place behind the advancing metaphysis, and the thickened metaphyseal end of the bone has remained unchanged. Disturbed tubulation may be due either to an underproduction of the bone-destroying osteoclasts, or an overproduction of the bone-forming osteoblasts, or both.

The disturbed tubulation found in the Rarotongans may be an example of Pyle's disease, familial metaphyseal dysplasia (PYLE, 1931 ; BAKWIN and KRIDA, 1937 ; HERMEL, GERSHON-COHEN and JONES, 1953 ; NEUHAUSER, 1953). Most of the Rarotongans do not fit the classic pattern of the disease, however, since they are of normal stature and leg length, while Pyle's disease patients are tall in stature due to elongation of the leg bones. Familial metaphyseal dysplasia, as the name implies, seems to have a genetic background. However, no data is available on the other family members of the children with disturbed tubulation.

Since familial metaphyseal dysplasia is only a remote possibility, it is more likely that the Rarotongans are demonstrating a diaphyseal aclasis, or one of the more common metaphyseal dysplasias (Jackson, Hanelin and Albright, 1954a, 1954b)

The problem of identification of this feature cannot be resolved with the data at hand, and would require full-scale x-rays of the whole skeleton before a more accurate diagnosis could be made There were no cases of pseudo-epiphyses

SUMMARY

Data from wrist x-rays of 164 Polynesian school children indicate that they are retarded in skeletal age when compared to a standard population from the United States The Rarotongan boys are retarded by significant amounts from 7 to 10 and at 13 and 14 years of age The Rarotongan girls are significantly retarded from 6 to 10 and at 13 years of age

It is suggested that this skeletal retardation in early childhood occurs because the children receive inadequate amounts of food Although adequate amounts of food are ingested in later childhood, the children are again retarded because the nutrients they receive are utilized in the pubescent growth spurt

Among the anomalies revealed by these x-rays was 1 case of capitate hamate fusion Failure of tubulation was observed in 14 digits and 2 ulnar shafts from 10 individuals The identification of this anomaly is uncertain, but one of the common metaphyseal dysplasias is a possibility

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THERAPY OF TRICHURIASIS AND ANCYLOSTOMIASIS WITH DITHIAZANINE

by

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Whipworm and hookworm infestations are rampant in the tropical and subtropical regions. According to STOLL'S estimate (1947) 355,000,000 persons were infected with the *Trichuris trichiura* and 456,000,000 with the hookworm. In the City of Colombo in Ceylon, DE SILVA (1956) reported a decrease in the death rate from 430 per million in 1925 to 80 per million in 1954, but there were still more than 500,000 attendances at the outpatient clinics in Ceylon in the latter year. 20 per cent. of all children admitted during 1950-1954 to the University Unit, Lady Ridgeway Hospital, Colombo had infestation with trichuris (DE SILVA, 1957).

WHIPWORM

The pathogenicity of *Trichuris trichiura* has been denied by some workers. We do not agree with this opinion, but concur with JUNG and BEAVER (1951) who emphasize that its potential pathogenicity is often overlooked. GRADWOHL (1948) summarises our views when he states : " When the parasitism is mild it may go unnoticed since no definite symptoms are present . . . When the number of parasites is very large, they can cause digestive disorders consisting of diarrhoea, abdominal pain and tenesmus simulating dysenteric syndromes or they may even cause a true dysenteric picture, sometimes these symptoms are associated with muscle guarding upon pressure or spontaneous pain in the caecal region."

We are in entire agreement with him. DE SILVA (1953) has reported that infants and children whose complaint was severe, chronic, offensive diarrhoea with blood, pus and mucus in the stools showed only *Trichuris trichiura* on repeated examinations of the faeces. Barium enemata have shown the appearance of ulcerative colitis in some of these cases. The whipworm is pathogenic when (i) there is a heavy worm load or (ii) in children who are suffering from malnutrition and/or anaemia with even moderate worm loads. Whipworm infestation may be often associated with severe anaemia and malnutrition. In many cases the common complaint is the passage of 5-6 bulky, mucoid stools, with or without blood, especially at night. Prolapse of the rectum with the typical white threads on the mucous membrane due to myriads of worms is sometimes seen in some of these cases. On examination with a magnifying lens, the bodies and tails of the trichurids may be seen wriggling about with their heads sunken and attached to the submucosa.

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* My grateful thanks to Professor C. C. DE SILVA for his kind co-operation and ready help and to Professor S. SIVALINGAM of the Department of Parasitology, University of Ceylon where the ova counts were done. Dr. PATRICIA FERNANDO, Dr. STELLA DE SILVA and Dr. E. H. MIRANDO for allowing me to treat their patients with this drug. Mr. ARESACULARATNE of the Department of Parasitology for doing the ova counts. The drug employed in this trial Dithiazanine iodide (Telmid) was kindly provided by Eli Lilly & Co., to whom we are most grateful.

STUDY METHOD

This trial was done on child patients in the University Unit of the Lady Ridgeway Hospital and at the Convalescent Home for Children, Ragama Only patients who showed a faecal smear positive for whipworm and/or hookworm were included in this trial Dithiazanine iodide was supplied in 100 mg enteric-coated tablets The course lasted five days The dose given was 5 mg per lb per day in three divided doses on the first day , on the second day the dose was doubled, that is 10 mg per lb per day also given in three divided doses The same dose was repeated on the third, fourth and fifth days The patients received only half the recommended dose (i e 5 mg per lb) on the first day as a precaution Ova counts of the stools were done by the Stoll dilution technique on the first day before treatment commenced and was repeated on the eighth day, that is, on the third day after completion of the course of Dithiazanine The ova counts were carried out within 24 hours of collection by the Department of Parasitology, University of Ceylon During the course of treatment all patients passed stools which were vivid blue in colour which served as a check on the release of the dye from the tablets

RESULTS

Data are summarized in Table I Twenty-four patients were treated in this way and 7 of them were given a second course two weeks later There were nine males and fifteen females in this series, their ages ranged from 1 year and 11 months to 8 years and their weights ranged from 13 to 30 lbs It should be noted from the weight range that all patients were undernourished They tolerated the drug well , only two patients vomited on the first day but tolerated the drug well after that It was noted that the consistency of the stools was well-formed after the course of treatment and the passage of dead whipworms in the stools during it was a common feature In patients who had prolapse of the rectum, improvement was noted by the reduction in number of stools passed per day and the disappearance of the prolapse during the fourth week or later after the commencement of treatment The children became more active and their appetites improved In those who were severely anaemic, this defect was corrected by whole blood transfusions and

TABLE I Results of Dithiazanine therapy of whipworm infestation

Case No	Sex	Age (yrs)	Weight (lbs)	Ova count before treatment	Ova count after treatment	Percentage reduction	Comments	Count after 2nd course	Percentage reduction
1	M	4	18	95,200	12,300	86 9%	Excellent	Nil	100%
2	F	5	13	5,400	2 500	53%	Good	700	83 3%
3	F	2	14	9,600	7 200	25%	Failure	16,000	0%
4	M	5	24	48,400	27 000	44%	Failure	48,000	0%
5	F	7½	24	48,000	6 000	70%	Good	4,800	90%
6	M	5	19	154,000	25,000	84%	Excellent	9,600	93 6%
7	F	7	22	6,000	1,200	80%	Excellent	Nil	100%
8	F	6	28	49,200	Nil	100%	Excellent		
9	M	7	26	4,200	Nil	100%	Excellent		
10	M	5½	24	41,700	Nil	100%	Excellent		
11	F	2	13	2,300	1,100	52%	Good		
12	F	4	26	3,000	4,000	33%	Failure		
13	F	4½	23	28 000	15,800	43%	Failure		
14	F	6	24	13,400	3 400	74 5%	Good		
15	F	6	22	25,400	Nil	100%	Excellent		
16	M	5	24	4,000	2,000	50%	Good		
17	M	8	30	76,400	Nil	100%	Excellent		
18	F	5	23	24 000	Nil	100%	Excellent		
19	F	7	26	3,500	Nil	100%	Excellent		
20	F	7	26	15,200	Nil	100%	Excellent		
21	F	5	27	11,100	5 200	53 1%	Good		
22	M	2	14	11,000	Nil	100%	Excellent		
23	F	4	17	9,300	Nil	100%	Excellent		
24	M	8	23	9,000	Nil	100%	Excellent		

intramuscular iron (" Imferon "). These patients were found to be intolerant to orally administered iron salts which tended to produce a recurrence of diarrhoeic symptoms. When oral iron was omitted and " Imferon " given instead, it was noted clinically that the anaemia responded rapidly. The highest ova count was 154,000 per ml. of formed stools and the lowest was 2,300 at the commencement of treatment. In the former case, the worm load was so heavy that it was reported not as a stool containing Trichuris ova but as trichuris ova with a little faecal material !

The reduction of the ova count was considered excellent when it was between 100 per cent.-75 per cent., good between 75 per cent.-50 per cent., and a failure below 50 per cent. Of the 24 patients treated, 14 gave excellent reductions, 6 good reductions and 4 cases were classified as failures. It should be noted that the lowest reduction of the ova count (Case 3) was 25 per cent. The above results are in agreement with those of SWARTZWELDER et al. (1958). Twenty of the twenty-four cases (83 per cent.) treated with Dithiazanine could be classified as successfully treated. Seven of these twenty-four cases were given another 5 day course of the drug two weeks later. Five of these seven showed excellent results and two turned out to be failures. It should be noted that a stool ova count is not an ideal criterion for the estimation of the cure rate, the percentage elimination of the worm is the ideal yard-stick. No one has yet shown for certain the correlation of ova counts with worm loads and also daily variation of ova passed in the stools with a given worm load. Two cases (Nos. 3 and 4) showed an increase in the ova count after treatment. It has been postulated that the reduction in the ova count is partly due to elimination of gravid female worms and partly to inhibition of ovulation of female worms remaining in the gut, but if stool smears showed no ova on three repeated examinations at weekly intervals then it may be assumed to be a complete cure. We were unable to do repeated weekly stool examinations in this study due to premature discharge of patients and to circumstances beyond our control.

HOOKWORM

In Ceylon the species of hookworm has been identified as *Necator americanus* (GOODWIN and STANDON, 1958 ; DE SILVA, 1957). GUNASEKERA (1953) showed that 68 per cent. of village school children in Ceylon were infected with multiple parasites usually the hookworm, whipworm or roundworm. DE SILVA (1957) has shown that out of a total of 5,860 stool examinations made by the University Unit, Lady Ridgeway Hospital for worm infestations during 1950-1954, 704 (12 per cent.) had ova of *Necator americanus* in the stools.

METHOD

The patients were treated at the University unit of the Lady Ridgeway Hospital and at the Convalescent Home for children, Ragama. The drug Dithiazanine iodide was administered in the same dosage as for whipworm, the course lasting 5 days. Stool ova counts were made on the first day prior to the commencement of treatment and on the eighth day, that is the third day after the completion of the course. Ova counts were done within 24 hours of collection because hookworms hatch out very rapidly. All ova counts were done by the Department of Parasitology, University of Ceylon.

RESULTS

Sixteen patients were treated, there were 5 males and the rest were females. Their ova counts ranged from 16,000 to nil (Case No. 4) prior to treatment. This patient who had no ova when the count was done had a stool smear for hookworm ova. Using the same criteria nine cases showed excellent and six showed good reductions in ova counts and one was classed as a failure (Table II). The percentage successfully treated was

TABLE II Results of Dithiazanine therapy of hookworm infestation

Case No	Sex	Age (yrs)	Weight (lbs)	Ova count before therapy	Ova count after therapy	Percentage reduction	Comments	Count after 2nd course	Percentage reduction
1	M	4	18	16,400	6,700	59%	Good	3 600	78%
2	F	5	13	900	Nil	100%	Excellent		
3	F	2	14	1,000	Nil	100%	Excellent	2,000	Nil
4	F	7½	24	Nil	1,400	Nil	Failure	1,800	Nil
5	M	5	19	12,600	14,600	68%	Good	500	96%
6	F	7	22	11,400	4 000	71 5%	Good	Nil	100%
7	F	6	28	10,500	Nil	100%	Excellent		
8	M	7	26	1,500	Nil	100%	Excellent		
9	F	2	13	400	Nil	100%	Excellent		
10	F	4	26	6,200	3 000	51 6%	Good		
11	F	4	24	1,800	Nil	100%	Excellent		
12	F	6	22	6,800	1,400	79%	Excellent		
13	M	5	24	5,100	1,800	64 7%	Good		
14	F	7	26	6,300	1,800	71 3%	Good		
15	F	5	27	4,500	1,000	77 9%	Good		
16	M	8	23	9,000	Nil	100%	Excellent		

93 per cent Five of these sixteen cases were given a second course of treatment, three of which showed excellent reduction in ova counts and two were failures GOODWIN, JAYAWARDANE and STANDON (1959) showed that the reduction of hookworm ova counts when treated with Bephenium (" Alcopar ") was 76 per cent and they claimed excellent results The reduction in hookworm ova counts in cases treated with Dithiazanine is slightly greater than that with Bephenium (FERNANDO, 1960) Three patients who also had ascaris ova on stool smear examinations prior to treatment with Dithiazanine passed roundworms and their stools were subsequently found negative for roundworm ova

SUMMARY

A clinical trial of Dithiazanine was done on twenty four child patients infested with *Trichuris trichiura* These patients showed a reduction in ova counts with a single 5 day course of treatment An improvement in their clinical condition was noted after treatment 83 per cent of patients were classified as successfully treated Sixteen children with hookworm infestation were treated with a 5 day course of Dithiazanine 93 per cent of patients were classed as successfully treated Dithiazanine is in our opinion the best drug at present available for the outpatient treatment of both whipworm and hookworm infestation in children The only disadvantage is that the course lasts for four days, there were no signs of any toxicity to the drug in the present series

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GROWTH IN HEIGHT AND WEIGHT OF ELEMENTARY SCHOOL CHILDREN
(WITH SOME OBSERVATIONS ON HEALTH AND NUTRITIONAL STATUS IN BANG CHAN, THAILAND 1952-55*)

by

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This investigation was undertaken in connection with the Cornell Thailand Project, one of several studies under the auspices of the Department of Sociology and Anthropology which are focused on the process of cultural change. During the preliminary study in 1948-49, children attending the Bang Chan elementary school were weighed and measured, and a table of median heights and weights, by age and sex was included in the first interim report (SHARP et al., 1953). Early in the intensive 5-year study, begun in 1952, a medical inspection of children in the school was carried out. The results of this inspection and a summary of observations on height, weight, bicristal diameter and cristal height of these children have been reported (HAUCK, 1956). Measurements made at the time of the medical inspection in November, 1952 were the initial measurements in the present study. Data on height and weight of the Bang Chan school children, obtained at intervals of approximately 3 months from November, 1952 to November, 1955, form the basis of this report.

REVIEW OF LITERATURE

Published information on heights and weights of school age children in Thailand is meagre, and all studies which we have been able to locate were cross-sectional. We sought particularly data on children 7 to 14 years of age, with which our observations could be compared. ZIMMERMAN (1937) included 593 boys and 367 girls within this age range, in his study of the stature and weight of the Siamese. The measurements he reported were on rural children, and were made in connection with a rural economic survey in

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1930-31. Zimmerman commented that the Thai were slightly shorter than the Southern Chinese, though he did not consider the difference significant As compared to most Asian people, Thai seemed to increase in height more slowly up to 6 years of age, but more rapidly thereafter.

Children from different parts of the country, both urban and rural, were included in the study reported by Dr. YONG H. CHUTIMA (1939). In the age range 7 to 14, 2,493 boys and 1,911 girls were measured. The tables showing average heights and weights included "such abnormal types as obesity, sub-nutrition and the very short stature" In other tables, the children were classified into 4 types : tall, medium, short and very short but the basis of this classification was not stated. The "very short" children were excluded in calculating values for the table of "average height and weight of Siamese normal types." In comparing our observations to those reported by Dr. Yong, we have used the tables in which he reported average values for all boys and girls measured.

An unpublished table, based on measurements of over 15,000 children, both urban and rural, made over a period of years, was in use by the Department of School Hygiene, Bangkok*. Subjects were grouped as Classes I and II, of which 1/3 were considered Class I. The basis for classification was not stated but at the elementary school age, mean heights and weights of children in Class II were below those for children of the same age and sex in Class I.

PROCEDURES

Subjects. All children attending the Bang Chan primary school during the period of observation, November 1952 to November 1955, were weighed and measured In all, observations were made on 293 children, 143 boys and 150 girls, between 6 and 14 years old. Ages of the children were taken from the school records. The initial measurements were made in November, and subsequent observations were made at intervals of about 3 months, as close to mid-February, mid-May and mid-August as could be arranged conveniently. School vacations were avoided by this schedule.

In Table I the age and sex distribution is shown for all children observed and for those whose records were used in this study. For individual children from 1 to 13 records were obtained, but data for a child were not included in the analysis unless at least 5 consecutive records, representing one complete year beginning with November, were obtained Most of the individuals whose records were not included entered school in May of the third year or left school in March of the first year of observation. Isolated instances occurred in which 5 consecutive records, from November to November, were not obtained because of absence from school.

In this report, where reference is made to the "cross-sectional study," records were included for the entire group of 217 children for whom we had 5 consecutive records beginning with November of 1952, 1953 or 1954. The data used were in effect a seri[illegible] for one, some two, and some for three years. In calculating average heigh[illegible] 7 through 14, observations made in November only were used. The 5 [illegible] November to November of each year provided evidence on seasonal variat[illegible]

For 60 children, a total of 13 records at approximately 3 month intervals, i.e. complete records for 3 years, were obtained. These data formed the basis for the longitudinal study. In this group, data were included for one child whose age at the nearest birthday was not certain. Data for this child were not used, however, in any analysis in which age was important.

The results of this study will be reported, therefore, for a group of 59 or 60 children when reference is made to longitudinal growth and for the entire group [illegible]

Collection of data. The methods and instruments [illegible] Briefly, the children were wei[illegible] of children weighing 22.75 kg. or more weighed which values to 1/4 kg. coulc[illegible] ighed considerably less than 1/4 kg., and would about 1/4 kg. ; clothing of [illegible] therefore [illegible] 10 a m. [illegible] 1/2 cm. [illegible] into the wood.

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* We were unable to obtain further information about the basis for this table except that the data were compiled by Dr. LAONG. The table was loaned to us through the courtesy of Dr. LADDA SINGHASENI of the Dept. of School Hygiene, Bangkok.

TABLE I. Age and sex distribution of the total number of children observed and of children whose records were used in this study.

Age in years*	Total number of children observed		Number of children whose records were used in this study	
	Boys	Girls	Boys	Girls
6	—	4	—	—
7	31	36	27	30
8	19	17	18	15
9	9	10	8	7
10	22	13	19	11
11	24	25	21	20
12	20	22	14	15
13	17	18	3	8
14	1	4	—	—
Age not certain	—	1	—	1
Total	143	150	110	107

* Age at the nearest birthday at the time of first observation.

The first observations, November 1952 through May 1953, were made by the senior author with assistants. The cooperation of the school teachers was obtained, and in May 1953 their training in the technique was begun. For the next year, field assistants in the Cornell Thailand Project were responsible for weighing and measuring the children, and for the third year, observations were made by the school teachers, with occasional supervision by a field worker.

Analysis of data. Records were classified by age and sex. For children observed in 1952-53, age at nearest birthday in November 1952 was the starting point. For each child, records were grouped from November to November. To be included in the cross-sectional study, at least 5 consecutive records for 1 year were required. For 2 consecutive years, 9 records were needed, and for 3 years, 13 records. Mean values with their standard deviations and standard errors were calculated for each group at each observation period each year, and for the entire group of the same age and sex, for all observations in the same month of any year. Median values were also noted.

To test whether an apparent seasonal variation in weight was statistically significant, the Student's t-Test for paired differences (GORE, 1952) was applied to weights of the 60 children included in the longitudinal study.

RESULTS AND DISCUSSION

TABLE II. Age and sex distribution of children included in cross-sectional study.

Age at nearest birthday (years)	Number* of children	
	Boys	Girls
7	3	6
8	30	27
9	34	42
10	42	32
11	44	36
12	39	33
13	18	16
Total	210	192

* Each complete year's record of one child was counted as one. Thus if a boy was first observed at 7 years of age, and 13 consecutive observations were obtained, he would be included with the 7, 8 and 9 year old boys.

TABLE III. Summary* of data on heights and weights of boys, 7 to 14 years old, Bang Chan Elementary School, 1952-55

Age	No.	Height			Weight		
		Mean	Median	Range	Mean	Median	Range
years		cm	cm	cm	kg	kg	kg
7	3†	112.5	111.5	111.5-114.0	18.6	18.8	18.0-19.0
8	30	114.5	114.0	103.0-125.0	19.3	19.8	14.5-23.0
9	34‡	118.1	119.0	109.0-127.0	21.2	21.0	16.0-28.5
10	42	123.3	123.8	113.5-135.0	23.2	23.0	18.0-29.0
11	44	125.8	126.0	116.0-135.5	24.0	24.0	19.0-31.5
12	39	129.8	130.0	119.5-141.0	26.2	26.0	21.0-34.0
13	18	133.3	132.5	125.5-151.5	28.3	27.5	23.0-37.5
14	12	141.1	138.0	132.5-160.5	33.0	30.8	26.5-44.0

* This includes all boys for whom 5 consecutive records were available beginning with November of 1952, 1953, or 1954. Observations made in November, only, were used in constructing this table.

† These three 7 year old boys were in school 1952-53. No complete records were obtained for 7 year old boys who entered during either of the other two years.

‡ One additional boy of this age was weighed but his height was not obtained.

TABLE IV. Summary* of data on heights and weights of girls, 7 to 14 years old, Bang Chan Elementary School, 1952-55

Age	No.	Height			Weight		
		Mean	Median	Range	Mean	Median	Range
years		cm	cm	cm	kg	kg	kg
7	6†	109.2	108.8	106.5-114.0	17.3	17.5	15.0-18.8
8	27	114.5	113.7	103.0-129.0	19.6	20.0	14.5-24.3
9	42‡	118.8	117.1	107.0-135.0	21.3	21.0	16.0-26.5
10	32	122.6	122.3	111.5-134.5	23.3	24.0	17.0-29.8
11	36	127.2	125.5	117.5-141.0	25.4	24.9	18.5-35.5
12	33	130.5	130.0	120.0-142.0	27.4	26.8	21.5-34.5
13	16	135.7	135.0	125.0-150.0	29.9	30.0	21.0-39.0
14	15	141.7	142.0	133.0-156.0	34.2	34.0	24.0-44.0

* This includes all girls for whom 5 consecutive records were available, beginning with November of 1952, 1953, or 1954. Observations for November, only, were used in constructing this table.

† These six 7 year old girls were in school 1952-53. No complete records were obtained for 7 year old girls who entered during either of the other two years.

‡ Measurement of height not obtained for 3 girls in this age group.

Cross-sectional study of growth. The age and sex distribution of children included in the cross-sectional study is shown in Table II. The summary of data on heights and weights for boys age 7 to 14, for the three years combined, is presented in Table III, that for girls, in Table IV. Values shown are for the November observations only.[1] Differences between mean and median values were small and inconsistent. Mean heights and weights of these boys and girls at successive years of age increased more or less regularly from age 7 to age 13. Up to 10 years of age, mean heights and weights were approximately the same for boys and girls, but thereafter, the girls were on the average, slightly taller and heavier than the boys.

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[1] Summaries, by age and sex, for each of the 13 observation periods were reported by THORANGKUL (1957), together with Standard Deviations and Standard Errors.

No clear indication was found of a growth spurt within the age range studied for the group as a whole. The largest mean increments in height and weight occurred between ages 13 and 14, but these groups were smaller and more variable than the younger groups. Thus the mean height with its standard deviation for 12 14-year old boys was 141.1 cm. ±8.8 cm. and their mean weight was 33.0 kg. ±5.7 kg. For the younger groups, standard deviations for mean height were about 5 cm., and for mean weight, about 2 to 3 kg. Several of the individuals remaining in school at 13 or 14 years of age had been taller and heavier than a majority of individuals in the larger groups to which they belonged at earlier ages. None of the 13 or 14 year old girls included in the medical inspection in November 1952 had reached the menarche.

The general trend in growth, especially the tendency for girls to grow faster than boys at about ages 11 to 13 was similar to that observed elsewhere (KROGMAN, 1956).

At the same age, the children in this study were almost identical in height with the group of rural children measured by Zimmerman in 1930-31 (ZIMMERMAN, 1937), and differences in mean weight were small. Compared to other groups of Thai children which included many from the cities (CHUTIMA, 1939 ; Bangkok, School Hygiene, Class II), the children in Bang Chan were somewhat shorter and lighter at each age. Heights of the Bang Chan children corresponded roughly to the 10th percentile of Iowa school children who were about two to two and a half years younger (STUART and MEREDITH, 1946). When mean weights of children in Bang Chan were compared with weights for children (Class II) of the same height and age, from tables in use at the Dept. of School Hygiene in Bangkok, the two curves were found to be similar (HAUCK, 1956).

The data were also analyzed to see whether seasonal variation in growth occurred. A number of studies indicating seasonal influence on weight and height have been made, particularly by European workers. Representative studies made from 1799 to 1948 were summarized in table form by MARTIN (1954). So far as we know, seasonal variation in growth of Thai children has not been reported by other observers. Indeed, in the reports available to us, no information was given as to the time of year when observations were made for the cross-sectional studies.

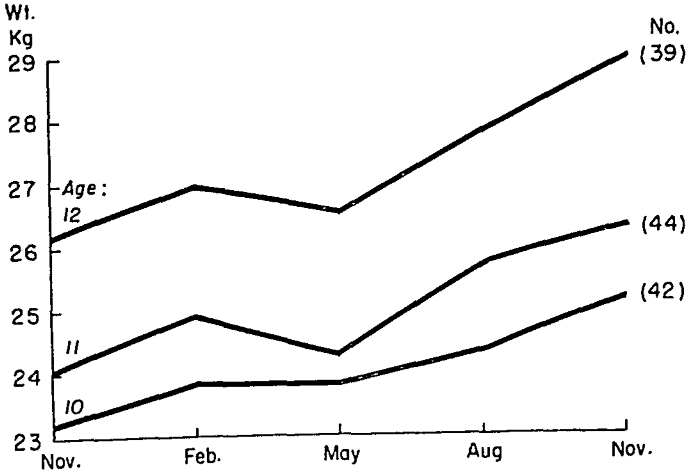

FIG. 1. Mean quarterly weights of boys, Bang Chan 1952-55.

In the present study, seasonal variations in weight gain were conspicuous both in the more than 400 annual records, each of which included 5 weighings at approximately 3-month intervals from November through November, and in the 60 records which extended over 3 years The percentage of the mean annual gain made in each 3-month period by the entire number of boys and girls in the cross-sectional study group is shown in Table V Illustrative curves of mean weight for 10, 11 and 12 year old boys, for the 3 years combined, are shown in Fig 1 When each age-sex group for each year was considered separately, the same sort of seasonal variation in weight gain was evident Thus, for the boys, in 1955, gains in the 3-month period, August to November, were 43, 50, 50, 50, 47 and 56 per cent of the mean annual gain for the age groups 8, 9, 10, 11, 12 and 13 respectively , i e all mean gains for this 3-month period were well over one-quarter of the mean annual gain for the age-sex group An average net loss from February to May occurred in 8 of 19 age-groups among boys and 7 of 19 age-groups among girls This was conspicuous for the year 1953-54, occurring in all age groups for both sexes

TABLE V Percentage of mean annual weight gain made in each 3 month period, by children aged 8-13, in the cross-sectional study groups

Year	Children		Percentage of mean annual weight gain			
	Sex	No *	Nov -Feb	Feb -May	May-Aug	Aug -Nov
1952 53	Girls	74	25 3	11 1	32 3	31 3
	Boys	83	24 1	11 8	34 5	29 6
1953 54	Girls	56	6 3	−44 3	100 7	37 3
	Boys	58	17 1	- 63 8	105 5	41 2
1954 55	Girls	62	37 6	2 0	12 5	47 9
	Boys	69	36 9	4 2	9 9	49 0

* The record of each child for whom 5 consecutive observations were available, beginning in November, of 1952, 1953 or 1954, was counted as one

When two quarterly values were combined, so as to represent weight at 6-month intervals corresponding roughly to the rainy season (May to November) and the dry season (November to May), mean weight gains were usually greater during the rainy than the dry season Among children included in the cross-sectional study, 290 made greater gains during the wet season as compared to 83 during the dry season

Mean differences in weight gains during the two seasons for each of the 3 years, are shown in Table VI for the 60 children in the longitudinal study group For the years 1952-53, and 1953-54, the differences were highly significant In 1955, continued poor gain beyond the observation in May appeared to be responsible for the less significant seasonal differences in gain for both boys and girls When the 3-month period August to November was compared to either February-May or May-August, the differences were highly significant We can, therefore, be reasonably sure that the seasonal variation in weight gains of these children was not due to chance If such seasonal variations in weight occur regularly among Thai children, the need to use weights observed at one time of year in constructing norms is evident Weight-age curves based on observations we made in November (Tables III and IV) would appear more favourable, than would such curves based on the observations made in May

TABLE VI. Mean differences in weight gains at various times of year, for 28 boys and 32 girls observed over a 3-year period, 1952-1955.

Year	Children		Weight gains were compared	Mean difference	Odds*
	Sex	No.			
				kg.	
1952-53	Boys	28	May-Nov. minus Nov.-May	1.66	>9999:1
	Girls	32†	May-Nov. minus Nov.-May	1.68	>9999:1
1953-54	Boys	28	May-Nov. minus Nov.-May	4.67	>9999:1
	Girls	32	May-Nov. minus Nov.-May	4.75	>9999:1
1954-55	Boys	28	May-Nov. minus Nov.-May	0.41	9:1
	Girls	32	May-Nov. minus Nov.-May	0.81	21:1
1955	Boys	28	Aug.-Nov. minus Feb.-May	1.35	>9999:1
			Aug.-Nov. minus May-Aug.	1.38	>9999:1
	Girls	32	Aug.-Nov. minus Feb.-May	1.64	>9999:1
			Aug.-Nov. minus May-Aug.	1.42	>9999:1

* Odds against a difference such as this occurring by chance.

† This includes 1 girl for whom 13 consecutive records were obtained, but whose age was uncertain, and for whom data could not be included when height and weight were related to age.

Growth in height was more regular, in these children, than gain in weight and no clear indication was noted of a seasonal variation in growth in height.

We can only speculate as to the cause of this seasonal variation in weight. Among possible explanations which should be investigated are variations in food supply with season, changes in activity with the cycle of farm work, and occurrence of illnesses such as might result from use of water from canals and fish ponds for drinking when rain water is not available.

Medical inspection was carried out in late 1952 to discover possible signs of nutritional deficiency (HAUCK, 1956). Such signs were found in 54 per cent. of the school children then in attendance, as compared to 6 per cent. of children 6 years old or under, and 24 per cent. of those aged 15 to 19 in the random sample of village households. Two or more such signs were noted in 19 per cent. of the school children, although little or no malnutrition of the sort that causes marked apathy, and no clearly defined deficiency disease was found among them. Haemoglobin values of 11.5 gms. or less per 100 ml. were observed in 9 per cent. of the children, but only one value was under 9.75 gms. Other signs most frequently observed were : xerosis of the skin (15 per cent.), enlarged liver (9 per cent.), dry staring hair (8 per cent.), leg ulcers (6 per cent.), phrynoderma (5 per cent.), and bowed legs (4 per cent.). Other changes in hair, skin, tongue and lips, and gums, absence of knee jerk and/or ankle jerk, enlarged spleen and enlarged thyroid were observed in from 1 to 5 children. The only instance of thyroid enlargement noted was in a 13 year old boy who had always lived in Bang Chan. The most prominent group of signs among school children were the skin signs, xerosis and phrynoderma. Even loss of elasticity of skin occurred in 3 boys. Among adults examined these signs were confined almost wholly to the group of older women. Absence of knee and/or ankle jerk was much more common among adults, particularly men, than in the school age group. Although a few instances of reddened gums were noted during the medical inspection in November *at the end of the rainy season, the dentist who examined the children's teeth 3 months* later during the dry season noted redness of gums in about 1/4 of the children

Infecting organisms were found in 68 per cent of single stool specimens obtained from 81 per cent of the children Nearly 2/3 of the organisms identified were protozoa or helminths which are pathogenic or which may cause diarrhoea (HAUCK, 1956)

A general idea of the food habits of these children was obtained from 526 records of food eaten during 24 hours, provided by 75 boys and 72 girls in the third and fourth grades (HAUCK et al, 1958) The need for improving the diets of these children was apparent both from the *qualitative dietary* records and *from the prevalence of possible signs of* nutritional deficiency

SUMMARY

Children attending the Bang Chan primary school during the period of observation November 1952 to November 1955, were weighed and measured at intervals of about 3 months At least 5 consecutive observations, beginning in November of 1952, 1953 or 1954 were made on 110 boys and 197 girls, 7 to 14 years of age Complete records for 3 years were obtained for 60 children

Height-age and weight age tables are presented based on the observations made in November of each year At successive ages, mean heights and weights increased more or less regularly From 11 to 14 years of age the girls were, on the average, slightly taller than the boys Both boys and girls in Bang Chan were somewhat less tall than urban Thai children of the same age

Seasonal variations were noted in weight gain, with greater mean weight gains from May to November, during the rainy season, than from November to May

Over half of the school children in attendance in November 1952, when the medical inspection was carried out, had possible signs of nutritional deficiency, but no clearly defined deficiency disease was found among them

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African Child Health

This Section of the Journal is devoted entirely to papers dealing with the health and welfare of the African Child.

B.C.G. VACCINATION IN RUANDA-URUNDI*

by

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The Belgian trusteeship territory, Ruanda-Urundi, covering an area of 54,172 square kms. in Central Africa, is limited to the North by Uganda, to the East and South by Tanganyika Territory and to the West by the Belgian Congo. The climate of this tropical country is tempered by the altitude (average altitude 1,700 metres).

Ruanda-Urundi is an economically underdeveloped territory with very limited resources, mainly pastoral and agricultural. It is a region of dense population (86 inhabitants per square kilometre). This population is not grouped together, but disseminated as families over the hills. The annual rate of population increase of 3 per cent. constitutes a grave danger of overcrowding.

Tuberculosis has long been known among the indigenous population and was possibly introduced by Hamite shepherds who, several centuries ago, came to Ruanda-Urundi from Ethiopia.

In 1951-1952 two CEMUBAC mass X-ray teams surveyed the country to determine the frequency of tuberculosis. The results showed 18.7 cases per 1,000 individuals, as judged by 153,631 examinations. The tuberculin test index for 49,957 individuals investigated was as follows :

Percentages of Positive Reactions		
Ages	Males	Females
0- 5	11.7	17.8
6-10	33.2	28.7
11-15	51.9	49.0
16-25	76.7	67.5
Adults	90.8	72.4
Total	61%	55%

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* Study made by the Centre of Medical and Scientific Research of the University of Brussels in Central Africa.

TREATMENT

Ambulatory treatment As has been pointed out, the population of Ruanda-Urundi is not grouped in villages, as in some parts of Africa, but is scattered in the hills This fact, together with the extremely uneducated state of the average inhabitant, rules out ambulatory treatment of tuberculosis in this region

Sanatorium treatment The treatment of tuberculosis cases has, therefore, been concentrated in two sanatoria, one in Ruanda directed by CEMUBAC, the other in Urundi run by the Government Medical Service The Government general hospitals also treat patients with tuberculosis whenever possible Once again, in view of the poverty of the average population, it is necessary to maintain hospitalization of patients until complete recovery, so that the treatment of each individual is extremely costly

For a population of 4 7 million inhabitants, there are probably about 80,000 cases of tuberculosis Of these, 15 per cent are "incurable," 4 per cent "quiescent cases," 81 per cent "curable"

There are, therefore, in Ruanda-Urundi, 64,000 treatable cases of tuberculosis It is obviously quite impossible, in an economically undeveloped country like Ruanda-Urundi, to undertake the hospitalization of this large number, and this is one of the reasons why activity has been concentrated on the prophylaxis by BCG vaccination

The aim was to investigate the efficacy of BCG vaccination in a poor population with limited hygiene and an unbalanced diet

A nutritional study undertaken by CEMUBAC shows the average diet to have

(i) a satisfactory caloric content ,
(ii) sufficient protein, but almost entirely of vegetable origin ,
(iii) a definite deficiency of fats ,
(iv) an excess of carbohydrates ,
(v) adequate calcium ,
(vi) deficient vitamin A and C

Efficacy of BCG vaccination This study was started in 1955 and at the end of 1959 we were able to draw definite conclusions

Basis of study Selection was made in three Ruanda Territories of groups for investigation composed of the entire population in these areas (men, women and children) and was followed by the establishment, by tuberculin tests and by mass radiography, of the incidence rate of tuberculosis Division was then made into two groups (A and B) identical as to race, nutrition, standard of living, etc In the group A, all the tuberculin-negatives were vaccinated , while in the group B, serving as control, this was not done All treatment was excluded for all individuals of both groups

In group A, an annual revaccination of the original group of negatives took place At the same time, each year, new arrivals in the group (by birth or immigration) were tested by tuberculin, and if negative, were vaccinated, and subsequently revaccinated with the original group

Three years later, groups A and B were submitted to further mass radiography furnishing a new tuberculosis incidence rate

At the beginning of our study, in 1955 and 1956, we examined, with tuberculin test and mass radiography, 83,419 Africans with the results shown in Table I, which shows that Groups A and B were identical for practical purposes

Three years later, in 1958 and 1959, after the vaccination of group A, the results were as shown in Table II

TABLE I. Results before BCG campaign.

Groups	Number examined	Number with tuberculosis	Tuberculosis per 1000 population	Percentage with allergy
A	54,966	665	12.1	50.35
B	28,453	342	12.02	55.34
A + B	83,419	1,007	12.07	52.32

TABLE II. Results after BCG campaign.

Groups	Number examined	Number with tuberculosis	Tuberculosis per 1000 population
A	57,348	230	4 01
B	31,414	360	11.46

RESULTS

In three years, as a result of the BCG vaccinations in Group A, the tuberculosis incidence rate fell from 11.46/1000 to 4.01/1000.

In group B, which had not been vaccinated, the incidence rate is more or less constant—11.46/1000 as compared with 12.02/1000.

Origin of cases of tuberculosis. Analysis of the actual cases of tuberculosis found at the second examination showed the following four classes :

(i) *Cases at second examination already shown to have tuberculosis at first examination.*

	Group A	Group B
First examination	665	342
Three years later	90	60

Percentage of survival : 13.53 per cent. in Group A
17.54 per cent. in Group B

(ii) *Cases among immigrants during the three-year period* (and therefore not supervised during the totality of those three years).

Group A			Group B		
Number examined	No. with tuberculosis	Tuberculosis per 1000 population	Number examined	No. with tuberculosis	Tuberculosis per 1000 population
2,833	34	12	6,304	70	11.1

(iii) *Cases among healthy tuberculin-positives at first examination.*

The results of the second examination of tuberculin positives, three years after the first examination, were as follows :

Group A : 92 new cases of tuberculosis for 25,506 individuals examined.
Morbidity rate in three years : 3.61/1000

Group B : 96 new cases for 13,863 individuals examined.
Morbidity rate in three years : 6.92/1000.

(iv) *Cases among tuberculin-negatives at first examination* (vaccinated or not)

	No of persons	No with tuberculosis	Tuberculosis per 1000 population
Tuberculin-Negatives in Group A (vaccinated annually)	28 919	14	0 48
Tuberculin-Negatives in Group B (not vaccinated)	11,187	134	11 98

These results show that the appearance of TB cases is 24 96 times greater where the tuberculin negatives remained unvaccinated These results are valid for double-dose vaccination (0 2 mgm)

Is natural protection against tuberculosis (tuberculin-positive individuals) more efficacious than the protection furnished by BCG vaccination?

In group A, 3 61/1000 of the original tuberculin positives became infected in three years In the same group, 0 48/1000 of those protected by BCG vaccination became infected in the same period It can be concluded that the protection furnished by BCG vaccination is 7 5 times more effective than that furnished by natural primary infection

Evolution of tuberculosis in group A

This is shown in Table III From which, it can be concluded that the protective action of the BCG vaccine is more evident at those ages when natural primary infection may be efficiently replaced by the BCG vaccination

TABLE III Evolution of tuberculosis in groups after three years of vaccination

Age (years)	1st Examination 1955 1956		2nd Examination 1958-1959	
	Number examined	Tuberculosis per 1000 population	Number examined	Tuberculosis per 1000 population
0 5	12,250	4 73	13,783	0 94
6-10	8,449	10 53	8,627	1 04
11-15	6,012	8 32	6 008	1 5
16-25	8,351	7 9	8,602	3 26
Adults	19,904	20 2	20,328	8 41
Total	54,966	12 1	57,348	4 01

TABLE IV Evolution of anatomopathological forms of tuberculosis after BCG vaccination

Forms of TB	1st Examination 1955 1956			2nd Examination 1958 1959		
	Nb Exams	Nb TB	TB/1000	Nb Exams	Nb TB	TB/1000
Pneumonic condensations	54 966	3	0 0546	57,348	3	0 0523
Fibrous forms	idem	321	5 8399	idem	114	1 9879
Fibrocaseous forms	idem	97	1 7647	idem	42	0 7324
Gangliopulmonary forms	idem	102	1 8557	idem	21	0 3662
Pleural lesions	idem	129	2 3469	idem	40	0 6975
Scissurites	idem	11	0 2001	idem	9	0 1569
Other forms	idem	2	0 0364	idem	1	0 0174
Total	54,966	665	12 1	57,348	230	4 01

Evolution of anatomopathological forms of tuberculosis after BCG vaccination

As was to be expected, the primary forms have decreased, as a result of the protective action of the BCG vaccine (Table IV).

Post-vaccinal allergy. The BCG vaccine used during this investigation was the lyophilized BCG vaccine of the Pasteur Institute of Brabant in Brussels. It was sent periodically from Europe by air, under refrigeration and was kept on ice up to the very moment of intradermal injection.

Vaccination was performed in the shade in a tent. The skin was immediately covered by a bit of adhesive tape to protect the area of injection from exposure to the sun's rays.

Allergy and post-vaccinal immunity are today considered as two distinct phenomena, but appearing simultaneously. According to W.H.O. studies, in vaccinated populations the immunity seems greater where the allergy is more marked. It is logical, therefore, to determine this allergy which, finally, proves only one very important thing—the certainty that the vaccine is alive.

Seven or eight years ago, our post-vaccinal allergic index was very low, about 65 per cent. Accordingly, we have since then systematically used a double dose of vaccine (0.2 mgm.). Table V gives the final results of our study, from 1955-1959.

TABLE V. Results of investigations from 1955-1959.

Post-Vaccinal Period	No. with positive Mantoux	Tuberculin positives	% Positives
3 months after initial vaccination	10,999	9,658	87.81
1 year after initial vaccination	24,487	16,763	68.46
1 year after 1st revaccination	26,817	23,732	88.5
1 year after 2nd revaccination	25,075	22,133	88.27

If we are to be guided by the allergy index, we must admit that diminution of allergy a year after the primary vaccination demands, in many cases, a revaccination, and that after several revaccinations, an allergy " ceiling " is attained limiting the allergy index.

There are two possible explanations for this limited allergy index :

(i) that the Institute Pasteur lyophilized BCG vaccine is of low antigenic potency ;
(ii) that the Ruanda-Urundi African, constitutionally or otherwise, cannot develop an allergy.

The second hypothesis is not considered as plausible in view of the following facts :

(a) biochemical studies of the plasma proteins among Africans do not suggest such a deficiency ;
(b) Africans easily develop a natural allergy to the tubercle bacillus (79.9 per cent. of the adults examined in our regions showed a naturally positive Mantoux) ;
(c) the lyophilized BCG vaccine does not give a higher rate of allergy when applied to a series of European children, in excellent health. (In a little town in Ruanda-Urundi, Kigali, four months after initial vaccination, we found 28 allergic cases among 42 students examined (66.67 per cent.)).

It is therefore concluded that the allergy produced by the dry lyophilized BCG vaccine is very much lower than that produced by the fresh vaccine in Europe.

METHOD OF FOLEY AND PARROT

It is extremely tempting in a country like the Ruanda-Urundi, which is densely populated, and where an urgent solution to the tuberculosis question is desirable, to resort to mass vaccinations, without the slowing up caused by preliminary tuberculin tests This mass vaccination is, in any case, obligatory in view of its efficacy and its financial possibilities Our object is to reach a maximum of inhabitants in a minimum of time to spare the population numerous meetings, and to avoid expensive use of medical personnel Furthermore, this method of vaccination does not necessitate the thousands of identity cards, with medical data continually revised and kept up-to-date by numerous employees, required by classical vaccinations

Disadvantages At present, a BCG injection to an individual suffering from tuberculosis, with the possible exaggerated allergic reactions that such an injection may provoke, is not considered as dangerous Nonetheless, the Foley and Parrot method necessitates a loss of vaccine, since it is injected indiscriminately both to allergic and anergic individuals This loss is, however, a very small part of the vaccination expenses and constitutes a minor disadvantage In any case, the classical vaccination is vastly more expensive

Value In 1955, after mass radiography, the Foley and Parrot method was used to vaccinate the 3,661 inhabitants of Gati hill The tuberculin index was 12 56/1000 In 1959, after three revaccinations, the tuberculin index had fallen to 5 32/1000 without treatment of any sort

Confident in these results, in 1959 for the first time 254,861 Africans were vaccinated by the Foley and Parrot method, and 31,839 individuals were revaccinated The maximum for one month was 99,000 vaccinations

In each region where vaccination according to Foley and Parrot had been undertaken, a system of control by mass radiography of a valid sample of each population has been continued, which will permit the situation to be judged after several years We can also, where desired, determine the pre- or post-vaccination allergy by following the BCG reactions a week later

CONCLUSION

The facts speak for themselves In a social antituberculosis campaign in Ruanda-Urundi, and in similar countries or among similar populations and conditions, the treatment of tuberculosis is expensive and inadequate in view of the number of affected persons and may in the future be supplanted in large part by adequate vaccination with BCG

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KWASHIORKOR IN SUDANESE CHILDREN

(CLINICAL NOTES)

by

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Kwashiorkor is not an uncommon nutritional disorder in Sudanese children and 48 cases have been seen in the Pediatric Department of Khartoum Hospital in an eighteen month period.

PRECIPITATING FACTORS

(1) *Social standard.* All the patients belonged to a poor class whose income and educational background were lower than the average.

(2) *Premature weaning.* In two-thirds of the patients there was definite history of premature weaning because the mother had become pregnant. It is unanimously believed by these various family groups that the milk of the pregnant woman is deleterious to the health of the infant at the breast, a view held widely in other parts of Africa.

(3) *Deficient post-weaning diet.* Dietetic deficiency among Sudanese children is mostly due to faulty habits and lack of maternal health education, yet poverty and shortage of food during summer are important factors. In all the kwashiorkor cases, the diet after weaning was deficient in protein, especially milk and meat.

(4) *Diet during pregnancy.* In 50 per cent. of cases the diet of the pregnant mother was deficient in meat.

(5) *Seasonal incidence.* The majority of cases (60 per cent.) reported to hospital during the months of October, November and December. The only possible explanation to this seasonal phenomenon is the common shortage of supply of meat, milk and vegetables during the dry months of May, June and July. In addition, the incidence of gastroenteritis is highest in July and August.

(6) *Age incidence.* In this series the youngest case was aged 10 months and the eldest three years. The majority of cases were in the age range of 1½ to 2 years.

CLINICAL MANIFESTATIONS

The onset was gradual in the majority of cases. In only three was the condition relatively acute and heralded by oedema of limbs. In one child, the condition was precipitated by an attack of measles.

(1) *Mental and emotional state.* The mental and emotional conditions of these children with kwashiorkor are markedly changed. It was observed that a stage of irritability was the earliest change of behaviour. The placid lively personality becomes ill-tempered and easily agitated. Later a stage of apathy and misery supervened.

(2) *Growth failure.* All these children, even those with the presence of gross oedema, were of less weight than the average for their ages ; while their lengths were also affected, although to a less degree.

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*I am grateful to Dr. Mirghani Yousif, Pathologist, Khartoum, for reporting on liver biopsy specimens, and to the Director, Ministry of Health, for permission to publish this paper.

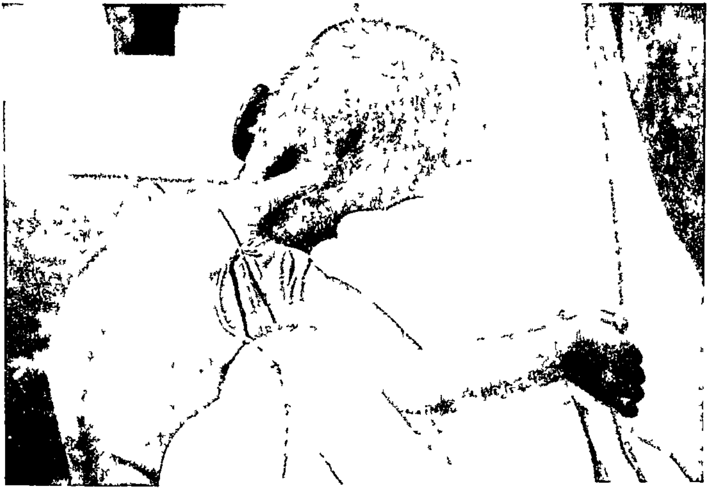

FIG 1 Kwashiorkor in Sudanese child, showing apathy, muscle wasting and abnormal hair

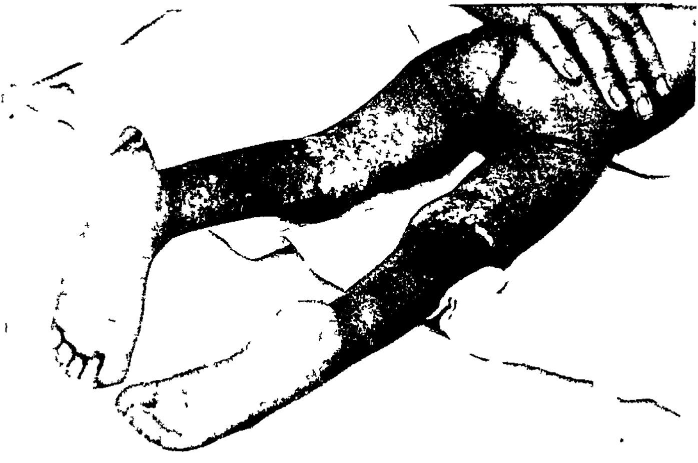

FIG 2 Kwashiorkor in Sudanese child, showing typical "flaky-paint" rash

The skull circumference measurements were found to be within normal limits for the age. The chest circumferences, when compared to that of the skull of the same child, were found to be reduced. This finding in my view is a significant indicator of failure of growth. This is because normally at one year of age the growth of the chest is equal to that of the skull, but after the first year of life the chest grows progressively faster.

(3) *Oedema.* Pitting oedema was present in all cases. It was the presenting symptom in 20 per cent. of cases. In the rest it was preceded by a varying period of ill-health, particularly gastroenteritis.

(4) *Dermatological changes.* The changes in the skin were striking and almost constant. They varied from pallor or mild dispigmentation of skin to "flaky paint" rash or ulcerations, over buttocks, flexer surfaces of legs, arms and genital surfaces. Chronic ulcers under lobes of ears were seen in one severe case. A "flaky-paint" rash was seen in 7 of these children and purpuric spots appeared in three. Blepharitis of eyelids were seen in 2 severe cases.

(5) *Hair abnormalities.* The usual colour of hair in Sudanese children is black and its texture varies from soft consistency especially in the North, to thicker hair in the South. The colour of the hair in the kwashiorkor cases had become reddish in a large group of cases (61 per cent.). In another group (36 per cent.) the normal black colour became dispigmented in variable degrees commonly to light brown. The hair retained its normal black colour in 3 per cent. of cases.

(6) *Signs of vitamin deficiency.* The following vitamin deficiency signs were commonly associated :

(a) Ariboflavinosis was observed in 70 per cent.

(b) In 35 per cent. there was a variable degree of swelling of gums which responded dramatically to ascorbic acid.

(c) The ocular manifestations of Vitamin A deficiency were observed in two cases.

(7) *Liver.* In normal Sudanese children, the liver edge may remain palpable up to the second year of life. In 60 per cent. of children with kwashiorkor the liver was not palpable. In 32 per cent. the edge was just palpable and in 8 per cent. the liver was enlarged to two or three cms. below the costal margin. Liver biopsy showed extensive fatty infiltration in all cases.

(8) *Anaemia.* This was a common finding ; it was usually normocytic.

BIOCHEMICAL INVESTIGATIONS

(1) *Plasma proteins.* In all the cases investigated, the total plasma proteins were much reduced below normal. The mean value of total plasma proteins was 4.01 g. per 100 ml. (the range was 2.96—5.7) ; albumin 1.77 (range 0.4—3.0) g. per 100 ml. ; globulin 2.39 (range 0.9—3.3) g. per 100 ml. The albumin/globulin ratio was therefore 0.74.

(2) *Miscellaneous.* With the exception of serum chlorides which were reduced (average value = 546 mg./100 ml.), all other investigations including serum sodium and potassium levels and liver function tests were normal.

MORTALITY

The mortality rate in the present series was 15 per cent. The main causes of death were intractable gastroenteritis and broncho-pneumonia.

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EDITORIAL

CHILDHOOD MALARIA IN HYPERENDEMIC REGIONS

The picture produced by Malignant Tertian malaria in hyperendemic regions (that is where infection occurs all or most of the year) is on the whole quite well known, although recent work has helped understanding and pointed out inadequacies in present knowledge

Basically, three stages are apparent The first of the usually immune infant, protected by maternal antibodies, with no apparent ill effects during the initial six months of life The last stage is also relatively untroubled, that is in the school-age group, as, by this time, an equilibrium (although a somewhat unstable one) has been reached between host and parasite

Rightly emphasis focuses on the second semester of life and early " pre-school age " when the young child fights the prolonged " battle for immunity," at a time when he is also burdened with malnutrition, intestinal helminths and sundry childhood infections

The cumulative effect of malaria during this period has been well shown by work in West Africa in the past few years As for example by comparing two groups of children in a hyperendemic region of the Gambia, one protected by antimalarials from birth and the other not so The latter group, at the age of three years, was found to be more anaemic, and to have a constant hepatosplenomegaly (McGREGOR et al, 1956) The result of continuous infection with *Pl falciparum* on the liver has also been demonstrated by WALTERS and McGREGOR (1960), who also showed that hepatomegaly was a constant feature and was principally due to sinusoidal dilation, as judged by liver biopsy That hyperendemic malaria is a cause of severe anaemia has also been emphasized in Tanganyika by DRAPER (1960), where haemoglobin levels of young children were substantially raised as a result of several years of malaria eradication by residual insecticides alone.

Of the grave syndromes of non-immune malaria (all probably related to regional anoxia of part of the body), probably cerebral malaria is the most diagnosed and, in some ways, the least easy to diagnose with certainty.

In very malarious areas, practitioners are highly sensitised to this condition and there is little doubt that children with fever, convulsions and some alteration of consciousness are often labelled " cerebral malaria " on slender grounds.

Possibly the basic difficulty is that the only conclusive diagnosis is histological,and, antemortem, even the cerebrospinal fluid changes in this condition seem uncertain and are glossed over in the text-books. A positive thick blood film is not, of course, diagnostic, while a negative slide may occur, according to some authorities (although it is many observers' impressions that this is not so, if due care is taken in staining and examination). Usually the slide will be strongly positive.

Plainly combined studies are needed to sort out this mixed group of febrile convulsions, encephalitides, cerebral malarias and so on. Investigation will have to be by pediatrician, parasitologist, clinical pathologist and virologist. Until such time as this is done, it will be necessary to treat all possible cases with parenteral chloroquine, although until more precision is possible in diagnosis, results of treatment on genuine cases of cerebral malaria will not be known.

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EXCERPT

ACCIDENTAL POISONING IN CHILDREN (Manchanda, S. S. and Sood, S. C. *Ind. J. Ch. Hlth.*, 1959, 9, 113).

The authors report 104 cases of accidental poisoning seen in Amritsan. Kerosene was the most common cause, followed by various household medicaments. Phosphorus was not infrequent (11.5 per cent.) as a result of ingesting the fireworks employed at Divali and other major festivals.

THE PAPUAN CHILD AS A SURVIVOR

by

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In the primitive regions of New Guinea a rational system of child care in a Western sense does not exist Instead we find the intricate but biologically highly efficient mechanisms of nature, amended by custom, not always sensible, of man in surroundings, which from a human viewpoint must be considered as hostile

The child as the young of primitive man, subsisting on his limited means of subjugating nature to his immediate needs, is more remote from us than ever before Westernized man hardly fits within the framework of biological considerations His society is sophisticated and his economy highly specialized

Yet it may be useful to go back a step and to examine more closely the health and survival of a child lacking all the conventional amenities How does he subsist, how is his state of health, how does he survive ? How does he cope with the risks of infective agents, the natural competitors in his existence ? How is the condition of his mother, who through gestation and lactation is physically responsible for the well-being of the infant during the important initial stages of development ?

After the period of intra-uterine life and breast-feeding, the child's health depends on the evolution of his food intake to the adult dietary pattern There is, of course, also a relation between the adult intake on the one hand and intra-uterine nutrition and the output of lactation on the other In the long run, everything depends on the family and local diet This in turn is determined by the physical environment

The diversity of environments produces a number of distinct dietary patterns Once one is a few miles inside the coastal areas where contact with the outside world has led to a limited acculturation, New Guinea is a wild, partly swampy, partly mountainous country with scattered small villages Most of these "villages" have less than 100 inhabitants, in fact an average of only 58 inhabitants A recent enumeration by GALIS (1960) of seven systems of counting in a selection of 131 languages may indicate the diversity of the population The staple food may be sago, elsewhere taro or sweet potato and sometimes banana The labour of collecting and transporting bulky foods in the far-off cultivated plots is part of the physical exertion of women, whether they are pregnant, lactating or not There is often no question of bartering products, neither of food reserves One of the causes of the limited caloric intake (typically about 1500 calories per capita at the lowest altitudes) must be the energy spent to obtain food

Another important aspect of the foods consumed is in how far they are suitable for the small child not yet possessing an adequate dentition There are no kitchen facilities to speak of Bulky solid tubers, even if cooked, are not the ideal infant fare Only those sago-eaters, who prepare sago as a porridge (*papeda*), can offer soft food acceptable to the small child They certainly do not neglect the opportunity ! Feeding starch is then started far too early and in too liberal quantities

Generally speaking, diet is undoubtedly the most critical aspect of survival for the Papuan child Twins often cause insurmountable difficulties for feeding A newborn baby deprived of its mother's breast perishes Insufficiency of breastmilk causes a slow starvation of the child

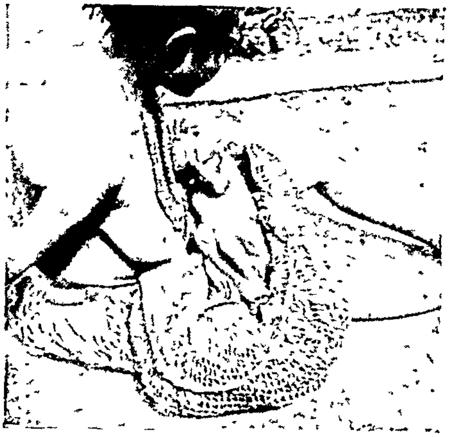


FIG. 1. Starvation at the breast (Wissel lakes) (Photo: Dr. J. v. d. Hoeven).

Drought periods, even for one or two months only, cause minor famines among the sweet potato eaters of the isolated highlands. A sago eater in the coastal belt, who falls sick or has an accident, may consider himself lucky because, he, at least, usually has some reserves in his home, be it only starch.

Besides diet, the factor which most influences the well-being of the small child is the presence of malaria, especially in the hyperendemic areas. The child has to cope with this, whether he has a satisfactory diet or not. A great help to the investigator in determining malaria incidence is the fact, that recurrent malaria leaves traces, in the form of more or less permanent enlargement of the spleen.

Of course circumstances are not uniformly bad everywhere, not even in some very primitive surroundings; and malaria prevalence is subject to many variations. The comparison between prosperous and unprosperous communities furnishes valuable information on essential aspects of health. In none of the localities to be considered now, traffic or wheel transport exists and currency hardly has any function. Of three localities the existence was not known twenty-five years ago. But now there are primary mission schools and, as a rule, they are " administered " insofar that there are more or less regular outside contacts.

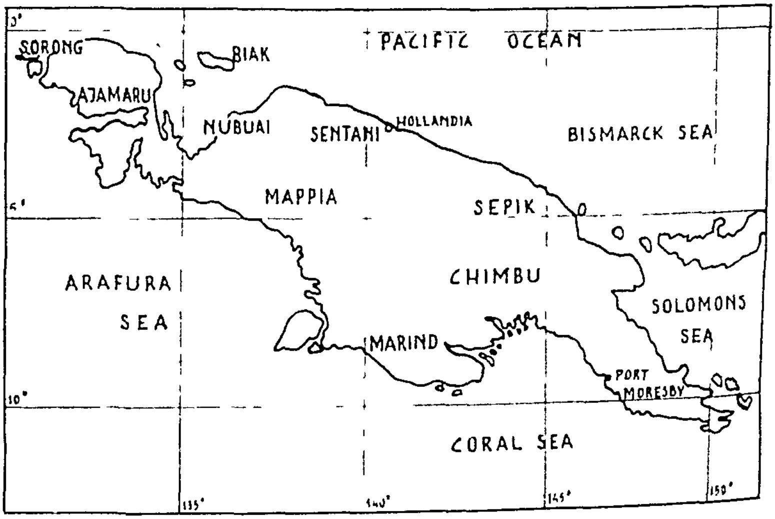


FIG. 2. Map of New Guinea.

Physical and dietary environments. A few typical environments will be briefly reviewed. Because of the importance of the mother's condition as regards the physical state of the infant, we will concentrate on the dietary intakes of pregnant and lactating women.

Ajamaru is situated in hilly country near a shallow lake. The traditional staple food is taro, but there is a rather large variation in supplemental foods, including green vegetables and peanuts and people regularly consume some animal protein.

By the site of *Biak* is meant a few villages in the hilly interior of the island of that name. The staple food again is taro, but this is eaten to a considerably greater extent. There is virtually no consumption of animal products.

Nubuai is a large village inside the mangrove belt. There is no firm, let alone cultivable, soil within

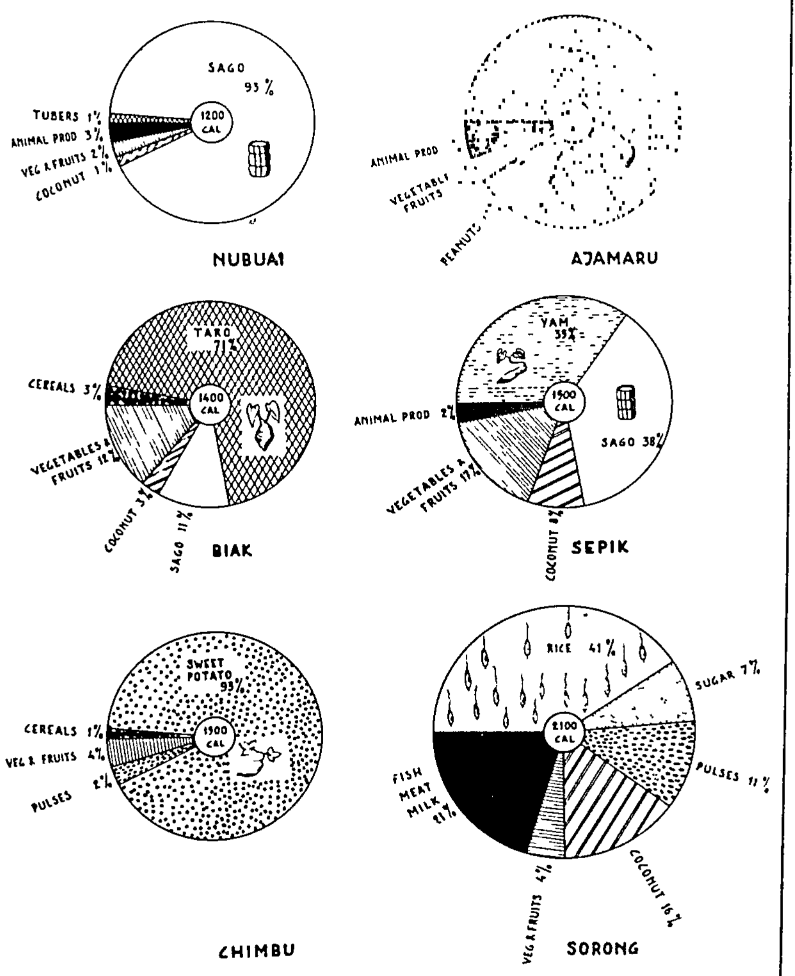


Fig. 3. Comparison of dietary intakes of Papuan pregnant and lactating women Left : extremely monotonous and limited diets , Right : more varied and acceptable diets , Sorong : European-type diet in industrial settlement.

eight miles. Houses are built on stilts above the salt water. People subsist on sago and a few by-products of their marshy surroundings, of which shell-fish, shrimps and fish are important.

Chimbu is in a high valley in the interior at 1,500 - 2,500 metres altitude. The climate is not tropical; the only cultivable tuber is the sweet potato. Green vegetables are popular, but animal products are absent. A thousand miles to the west in similar surroundings lies the Mappia site.

The *Sepik* site is 250 miles upstream on the river of that name, in the central depression of the eastern half of the subcontinent. People use sago and yam as staple foods and have access to animal products of the river.

Totally different is the oil settlement of Sorong at the Western tip of New Guinea. It is wholly artificial. People live mainly on rations, and canned foods, including milk, are prominent.

Of these Ajamaru and Sepik are rather prosperous in a purely native way. Nubuai, Biak and the mountain sites are presented as examples of poor-food patterns. Sorong is used as a contrasting situation of Papuans living in a sophisticated environment. It is, however, useful to remember that the inhabitants as a rule have only benefitted by the local amenities for about three years (Fig. 3).

Significance of observations. The author is uneasily aware of the fact that the diets of Nubuai, Biak and Chimbu belong to the most limited intakes so far described in free populations. They should, however, be considered as typical local examples.

The causes of the extreme poverty of the diet, particularly in regard to protein (the consequences for other nutrients may be imagined) are :

(1) the preponderance of sago and tubers (taro, sweet potato and yams) as staple foods, often accounting for 90 per cent. of the caloric intake. (Sago is washed-out starch and contains only " naked calories "). Two kilos of tubers a day, a normal portion for an adult male would provide about 2,000 calories and perhaps 25 grams of actual protein. The protein portion counts for very much. The calculations for sweet potato were based on a conventional value of 1.3 per cent. crude protein. Recent analysis of highland strains showed a variation between 0.7 - 1.6 per cent. protein. This would mean that a pregnant woman consumes either 13 or 33 grams of protein daily.

2) the unavailability of protein-rich foods. Papuans of the interior are for practical considerations vegetarians, except when they have access to aquatic animals ; they seldom have legumes. Those on the coast consume animal products in significant quantities ; but even then their staple is devoid of protein. In this environment (example : Nubuai) we encountered the lowest values. In a pregnant women, the protein portion varied between nine and fourteen grams a day only.

TABLE I. Protein and calories in typical daily intakes of pregnant and lactating Papuan women in different regions.

Region	Calories	Vegetable protein	Animal protein	Protein g./100 cal.	Protein g./kg.
Ajamaru	1450	20	11	2.1	0.7
Nubuai	1170	4	10	1.2	0.3
Biak	1400	13	0	1.1	0.3
Sepik	1470	16	7	1.6	0.5
Chimbu	1490	19	0	1.3	0.4
Sorong	2100	35	34	3.3	1.7

The determinations in Table I and Fig 3 were made (by Miss Malcolm) on samples considered representative for the respective communities They comprise observed and measured daily consumptions of 10 60 subjects during 4 6 days In the case of pregnant and lactating women, and of children, the calculations were based either on individual portions or on an observed share of the family pot (OOMEN and MALCOLM (1958) , JANSEN (1959))

We cannot avoid the conclusion that *pregnant and lactating women can subsist on a protein intake of* 0 3 - 0 4 *g per kg weight per day* and can do so without apparent harm at 0 6 0 7 g per kg , while an intake of 1400 - 1500 calories (in the lowlands) meets their needs

THE MOTHER

Physical condition Obese women are a rarity in native Papuan communities They are no exceptions in Melanesian women of the New Hebrides and New Caledonia, who are not living in a subsistence economy and who enjoy more liberal diets On the other hand the women of Ajamaru and Chimbu are often quite buxom There is a great variety in stature, even when we exclude the pygmies In the groups considered here, average heights of women varied between 141 cm in a mountain tribe (Mappia) and 155 cm in the coastal Marinds, suggesting a difference in basal metabolism of about 30 per cent (Table II) The Sorong women (belonging to smaller racial groups) do not achieve a higher average height than their counterparts in native communities , but then, they were born elsewhere LUYKEN et al (1960) found the blood cholesterol level of Papuan women at Biak and Mappia to be low (134 and 163 mg per cent respectively) At Sorong it was higher

TABLE II Physical values of Papuan mothers

Region	Weight (kg)	Height (cm)	Basal metabolism* cal
Ajamaru	42	147	1140
Nubuai	42	148	1150
Biak	42	149	1150
Sepik	43	151	1170
Chimbu	48	152	1240
Sorong	42	146	1140
Mappia	33	141	990
Marind	51	155	1290

* Height-weight formula (Aub & Du Bois)

In Papuan women the connection between physical welfare of the mother and that of her child is extraordinarily close, far more so than in western countries The physical demand put upon a woman in the task of obtaining her daily fare, was already hinted at On these trips to and from the " gardens ", and during the work done, she is usually carrying, and now and then feeding, a suckling and she is handicapped in her work by the need of constantly supervising several toddlers. Moreover, she may be pregnant, which means that she is always eating " for two."

How strenuous is her work ? How many calories may she need for energy ? Periods of leisure (called " laziness " by the superficial observer) alternate with heavy manual work. She does seem to avoid subconsciously all haste and she tunes down the pace of movements of western counterparts. Still, one should not underestimate the energy expended by a small woman carrying a 20 kg. load (including a child) over two miles in rough hilly country (Fig. 4). If it is true that a moderately active life is possible on 50 per cent. calories above the basal metabolism then the latter must be low. On this supposition the basal metabolism seldom attains 1,000 calories and may be as low as 800. This is 20 - 30 per cent. less than the values calculated on a conventional height-weight formula.

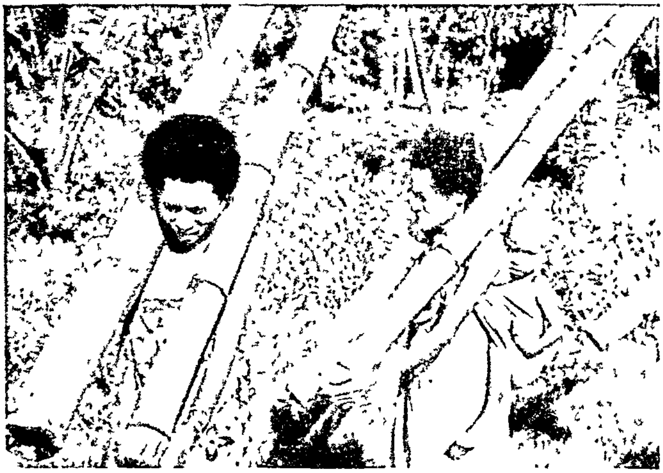


FIG. 4. Carrying heavy loads of water over miles. (Waropen coast).

Birth-weight. How efficient as a child bearer is a woman, living constantly on a low-calorie, low-protein diet, especially in relation to the birth-weight of her offspring? A number of representative figures from aboriginal surroundings could supply this information, but, of course, they are difficult to obtain. Every improvement of mother and child care tends to disturb these figures. VEEGER (1959) remarked that malaria prophylaxis during the last months of pregnancy in Marind women resulted in a considerable increase of birth-weights. The lowest figure (Inanwatan) available stems from a locality where malaria at the time was hyperendemic.

The probable variables influencing birth-weights in regional random samples are stature of the mother, malaria and its sequels and malnutrition. These are impossible to unravel in several of the examples mentioned (Table III). There are, however, a few noteworthy points. The weight of the Chimbu newborn, of an environment comparable to that of the dietary figures, with no local malaria, compares favourably with those of Sorong where nutrition is ample and malaria transmission absent. Similar birth-weights are shown by the babies of prosperous Chinese at Singapore (MILLIS, 1952) and by middle class Indonesians at Djakarta (NJO TIONG TJIAT, 1951). In both the stature is similar and malaria is absent. But the diet of the mother, especially in the former, is far more adequate. In these smaller races an average birth-weight of about 3,000 grams would be normal. In the taller Caucasians and. Polynesians a comparable figure would be 3,300 - 3,400 grams.

Although anything but complete, the available figures suggest that even at maternal protein intakes as low as 20 grams daily or less, the birth-weight of her newborn does not deviate much from the expected normal. The discussion of contrary evidence, of dietary differences on far higher levels, must be adjourned until more complete figures are available. After all actual weight is only one aspect of the physiological make-up of the newborn.

Some interesting remarks, made by SCRAGG (1955), should be noted. In Kavieng

TABLE III Weights of Papuan newborn

	Number	Males	Females	Source
Inanwatan	33	2320 (mixed)		MCH service
Kavieng	393	2660	2670	Native hospital (1)
Marind	57	2960	2880	MCH service
Biak	178	2920	2900	Native hospital (2)
Chimbu	82	3080	2980	id
Sorong	45	2970 (mixed)		id
Rabaul	1107	3020	2880	id (1)

(1) SCRAGG, 1955 (2) JANSEN, 1959

in New Ireland (Table III), there is not the usual variation between male and female mean birth-weights. He suggests that the low weight-level is not sufficient to produce the sexual difference commonly found in babies of greater birth-weight. These babies recovered their birth-weight on the fourth day after birth. This he considers likewise as a consequence of their low birth-weights.

Spacing of births. As a rule the average Papuan mother seems either to be pregnant or lactating. Though it is difficult to generalize on the spacing of births, an interval of less than two years would be an exception in native surroundings. One apparent reason is the protracted period of breast-feeding; a less convincing one is the sexual abstinence required by taboos until the child manifests certain skills; an obscure one, the often heard-of practices of abortion, though the means do not sound very effective.

In Papuans subject to acculturation, the practice of prolonged lactation and the wide spacing of births is soon disturbed. An example is furnished by Papuan police-women living in barracks.

JANSEN (1959) compared the spacing of births in native villages of Biak Island with those in the "sophisticated" oil settlement at Sorong. There was an average difference in interval of about ten months (Table IV).

TABLE IV Spacing of births in native and in sophisticated Papuan surroundings (in months)

Birth no.	2	3	4	5	6	over 6
Biak, coast, interval	30	30	27	28	30	29
Number	(142)	(116)	(94)	(75)	(52)	(66)
Sorong interval	18	20	20	18	20	18
Number	(25)	(22)	(19)	(16)	(9)	(13)

A conservative guess of the stress of reproduction for the average Papuan mother in primitive surroundings would be of 5 to 7 pregnancies resulting in live births and of four or more complete periods of lactation of roughly two years; resulting in a period of well over 15 years that she is either pregnant or lactating. It would be the exception even in prolific western mothers who match their aboriginal counterparts in this respect. If the physiological burden of reproductive processes for well-fed mothers in prosperous surroundings is as strenuous as is commonly believed, then this burden should be considered as extraordinary in case of the Papuan.

Number of children. Comparable figures of the number of live births per Papuan mother are rare. A rough approximation (by the method of interviewing) for the regions discussed is given in Table V. The data are only concerned with mothers with children from 0 - 6 years old ; averages after completion of the child-bearing period are higher.

TABLE V. Live and dead children per mother in diverse regions.

Region	Number of mothers	Live births	Dead children per mother
Marind	(33)	3.6	0.7
Sentani	(106)	4.0	1.6
Nubuai	(248)	4.6	1.5
Ajamaru	(82)	3.1	0.5
Chimbu	(102)	3.4	1.0

Though the figures have only comparative value, they suggest a high natality and mortality where the diet is poor and/or malaria prevalent (Sentani and Nubuai) and a lower natality and low mortality where the diet is satisfactory and malaria less prevalent (Marind and Ajamaru).

The available documentation suggests that even populations under very difficult dietary conditions — perhaps so for centuries — slowly increase. There are depopulation problems in New Guinea, but they do not affect for instance Nubuai, which is now a large (one of the largest) village of 2,000 inhabitants. Could it be that the female under very difficult conditions is yet able to ensure the continuation of the species, but at the price of a considerably higher waste of infant life ?

Lactation. Breast-feeding in native surroundings is a matter of life or death for the infant : for Papuan communities it is an important demographic factor. How is the output and the quality of breastmilk affected by the often poor diet of the mother ? (Fig. 5).

Miss MALCOLM (OOMEN and MALCOLM, 1958) investigated the amount produced by the method of expression after an interval of non-suckling, in the various groups of which the diet has been indicated earlier. Comparing three particular regions, she found in Ajamaru, where the diet was the most satisfactory, that the quantity produced in the second half year of the child was relatively high and that even in the third year after birth an appreciable amount was secreted. In Nubuai the production was not much less in the second and third half year, but at an age of one-and-a-half years the relative quantities declined earlier and many mothers, though willing, stopped because of lack of milk. In Chimbu the secretion in the third and fourth half year was still reasonable ; but though breastfeeding was protracted well into the fourth year, the quantities then obtained were small.

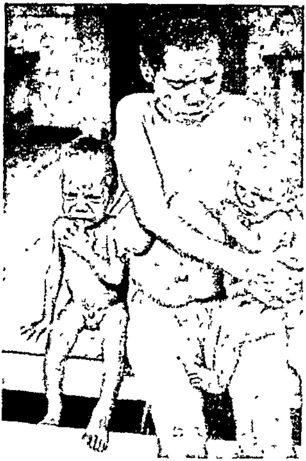


FIG. 5. Infant and toddler are sometimes competitors at the breast (Chimbu).

The data of Table VI are averages of local groups. In individual cases the production may be more impressive. 22 per cent. of the Ajamaru women produced over 530 ml. per day in the second year ; one 430 ml. within 12 hours, suckling a child of 18 months; another with a child of 30 months in the same period 380 ml. A Chimbu woman with a child of 51 months on one occasion still produced 150 ml. in 12 hours. It is not here the exception that counts, but the possibility of secreting these imposing quantities of milk on poor rations over very protracted periods.

It is difficult to match these examples of late lactation with representative figures for babies in the first six months. Both test-feeding and expression methods disturb their dietary routine. On less complete evidence we surmise that in the meagre regions many infants would not have more than 400 ml. a day, despite the greater efficiency of intake in a small baby ; while under more auspicious conditions this would be 600 - 700 ml. As a physiological performance the emphasis would again be more on the duration of lactation than on the actual quantities.

TABLE VI. Estimated average quantities of breast-milk in 230 women, available in 24 hours (Local diet indicated in Fig. 3).

Months :		6— 12—	12— 18—	18— 24—	24— 35—	36— 48—
Ajamaru (1)	ml no	350 — 480 (15)	270 — 360 (35)	230 — 310. (34)	230 — 300 (19)	
Biak (2)	ml no	390 — 430 (12)	190 — 270 (18)			
Nubuai (1)	ml no	310 — 410 (32)	250 — 340 (16)	150 — 210 (10)		
Chimbu (1)	ml no			230 — 300 (11)	140 — 190 (18)	110 — 140 (10)

(1) OOMEN and MALCOLM, 1958. (2) JANSEN et al., 1959.

In two of the quoted examples, the composition of the breastmilk is known. At Chimbu, VENKATACHALAM (1959) found the protein content to be within "normal" limits. From the dietary poor surroundings of Biak, however, JANSEN et al. (1960) reported a protein content of only 0.83 - 0.89 per cent. The difference is important ; it could mean that a Papuan woman has to contribute either four or seven grams of her protein intake of 15 - 20 grams to the composition of her breastmilk, and this for a period of about two years. According to the authors quoted, the fat content of breastmilk samples of Chimbu and Biak was low. In racially akin, but dietarily more prosperous, women of the New Hebrides, PETERS (1953) found rather high protein levels (1.33 - 1.49 per cent.).

WALKER (1958) commented favourably on the efficiency of prolonged secretion of high-protein milk in Bantu women having a protein-intake of about 1.0 g./kg. daily. GOPALAN (1958) on the other hand, views with concern the intake of 45 - 60 g. in poor Indian lactating women, though they still had a positive N-balance and concludes that their physiological requirement would be about 1.5 g. protein/kg. bodyweight. Both authors considered women on a monotonous diet of which, in contrast with our examples, the staple consisted of cereals.

In Papuan society, the performance of suckling by the mother impresses one as a natural and rather irrevelant procedure. She often behaves as if she is not aware of it. Especially in Nubuai, however, it was apparently viewed with great concern. The colostrum was meticulously judged as fit or unfit for consumption. An unreasonable preference often caused the women to use one breast only. As often as not suckling infants of varying ages were exchanged to the breasts of other women, considered better feeders. First foods (starch) were introduced very early. Especially here we felt more than we can express in figures, that the dietary situation was in conflict with the possibilities of lactation.

To all appearances, the mammary gland of Papuan women is easily stirred into activity. We observed two grandmothers, who had not borne children in 11 and 14 years, suckling a grandchild and yielding appreciable quantities of milk. The custom is well known in many villages.

There are no convincing indications that the suckling child " milks the flesh off his mothers' back." In a series of determinations by JANSEN, the weight of lactating women, if anything, was not less than that of comparable non-pregnant, non-lactating counterparts (Table VII).

Blood composition. There are few clinical means of reliably judging small differences in physical condition. One often used methods examines the levels of blood constituent. In this respect there is sometimes a close relation with nutrition and nutritional disease, though the relation is not always strict and not confined to a single nutrient, as in the case of haemoglobin. There are other relationships, for instance between infection and gamma-globulin levels. If there are significant effects of poor diet on the physique of the mother, we would expect to find them reflected in the composition of her blood, especially during periods of stress, like pregnancy and lactation.

JANSEN collected blood samples in New Guinea and determined haemoglobin values (Sahli method) and serum protein levels (electrophoresis). He compared the levels in different regions and the differences between non-pregnant—non-lactating, lactating and pregnant women (Table VII).

There is a notable difference in haemoglobin content between Sorong where nutrition is satisfactory and malaria not prevalent, and the nutritionally poor, malaria infested villages of Nubuai and Biak, but it is difficult to decide which influence dominates. HIPSLEY (1950) compared the average haemoglobin levels in malarious subjects with those showing no evidence of malaria in five villages of Australian New Guinea (mixed samples). There was a significant correlation in the differences between both groups. Parasite carriers had a mean level of 10.3 g. per cent., subjects with palpable spleen 10.0 g. per cent. and subjects without malaria evidence 11.1 g. per cent.

There are minor differences between the localities in regard to total protein and albumin content and the albumin/globulin rate, but the values observed do not exceed the normal range. The poorly fed pregnant or lactating mothers of Biak and Nubuai have essentially the same serum composition as their well-fed counterparts at Sorong.

Pregnant women present the lowest values under any heading ; but this would be expected in view of the increase of plasma volume in pregnancy ; as such, these levels do not appear abnormal In view of the earlier comments on lactation it is striking that no significant difference due to lactation was observed There is, according to JANSEN, a decrease in beta-globulin in the consecutive periods of lactation However, this would not detract from the fact that serum levels, most often found to be low in protein malnutrition, maintain apparently normal values in women on restricted diets, despite interference by pregnancy or lactation

TABLE VII Composition of blood and weights of non pregnant — non lactating lactating and pregnant Papuan women (Jansen 1959)(1) (Pregnancy second half, lactation first year)

	Hb g %	RBC millions	Tot prot g %	Alb g %	Alb /glob	Weight kg
Nubuai						
non preg/non lact (2)	9 1		7 3	3 3	0 8	40
lactating	8 9		7 1	3 1	0 8	42
pregnant	7 7		6 3	2 5	0 7	
Biak						
non pregn/non lact	9 0	3 0	7 3	3 3	0 8	40
lactating	7 8	2 7	7 3	3 2	0 8	41
pregnant	7 5	2 5	7 0	2 8	0 7	
Sorong	(3)					
non pregn/non-lact (2)	11 3	3 5	7 7	3 8	1 0	42
lactating	12 2	3 7	7 7	3 9	1 0	42
pregnant	9 6	3 1	6 4	2 8	0 8	

(1) Chimbu (VENKATACHALAM) non pregnant women Hb 14 67 % (not corrected for altitude), total protein 7 7 g %, albumin 3 3 g %
(2) < 10 determinations
(3) Papuan hospital nurses, 12 3 g %, Dutch resident women, 13 3 g %

THE CHILD

Diet About 50 per cent of the infants at Nubuai and Ajamaru were still being suckled at the age of two years, in the Sepik and Chimbu areas this percentage was higher still With increasing age the regime of feeding changes It may be called "feeding on demand" in the very young baby, but later on there is a compromise with the chores of the mother Even at an early age the mother may leave her baby at home where it is comforted with chance feedings by available substitutes Towards the second year, feeding periods are less frequent and less regular The suckling toddler draws his greatest quantities at dawn and in the evening For stopping breast-feeding the most frequently professed reason is pregnancy, and that mostly in the second half.

An idea of the quantities of milk involved has already been given The implications of "weaning" should be understood It is seldom a sudden suspension, as in the Trobriands Usually first foods are introduced gradually in increasing quantities and variety

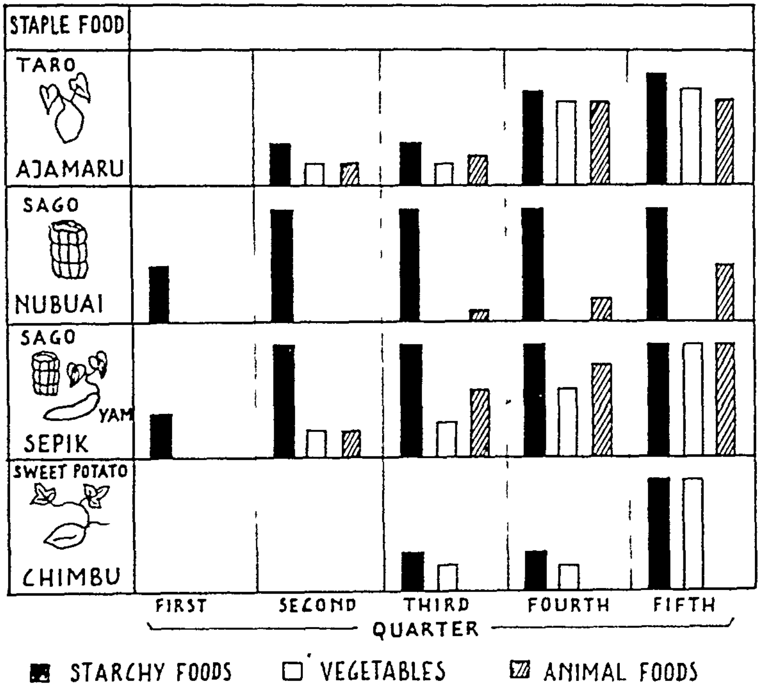


FIG. 6. Introduction of first foods in diets of Papuan children. Large regional differences connected with local diet and staple-foods. (Columns indicate percentage of consumers.)

There is a great variation both in the procedure and the composition. Sago, where available, is given early, either because of its more suitable consistency or out of necessity. Tubers and other solid foods are premasticated. The order in which tubers, vegetables and animal foods are introduced often does not seem to make sense ; availability and taboos are the decisive factors. The diversity of practices is indicated in Fig. 6.

At the Sepik and in Ajamaru, a year old child has a diet, consisting of tubers, vegetables and fish. In Chimbu, animals products are not available ; at Nubuai, both vegetables and animal food are introduced late. In the last place, the breast-milk in a year-old baby usually is not supplemented by anything better than starch (Fig. 7). This often results in extremely low percentages of protein (and other nutrients) in the diet, which may be as low as 0.4 g./kg. body weight. Therefore even at this late stage the significance of breast-milk for the child needs no comment.

The fact that child mortality in the "bad" regions (Biak, Nubuai, Chimbu) is high, is less remarkable than that so many children manage to survive. Yet all the evidence appears to indicate that the adolescent and adult population we see before us, must have grown up at these minimal rations.

It is especially the two year old child who bears the brunt. As soon as the child is less dependent, the situation alters in its favour. Its relative protein requirements are lower and it has ways of obtaining extras. Nevertheless, the quantities con-

FIG. 7. Grandmother feeding sago starch with bamboo pincers (Waropen, Nubuai).

TABLE VIII Typical average intakes of children

Region	Age Weight kg(2)	7 months(1) 5 8	2nd year(1) 8	2 6 years 14	7 12 years 20
Ajamaru	calories		550	930	
	protein g		18	27	
Nubuai	calories	180	460	550	710
	protein g	0	2	5	7
Sepik	calories		610	770	1220
	protein g		8	9	19
Chimbu	calories		420	950	1220
	protein g		5	13	16

(1) not including mothers' milk (2) calculated at central ages

sumed of calories, protein, vitamins,calcium etc are anything but reassuring The lowest values in our surveys indicated 40 calories and 0.7 - 0 9 g protein per kg bodyweight, while 50 - 70 calories and 1 2 - 1 6 g protein were frequently recurring values (Table VIII)

It is noteworthy that apparent protein consumption per kg weight is relatively better in the older toddler and the school-age child It is then often higher than in the period around the first year or in adults while greater proportions of non-staple foods enter into the diet

Growth SCRAGG (1955) investigated the weight variations in the first week of life of New Britain and New Ireland babies born in hospital He concluded that the larger (Table II) Rabaul babies recover their birthweight on the seventh day after birth , the smaller Kavieng babies, as already stated, regained their initial weight loss on the fourth day

SCRAGG further studied the weight increase of Kavieng infants during the first thirty months The children were subjects of infant welfare activities in the Kavieng sub District Their weight doubled in three months, contrasting with the five months which the average Caucasian baby needs to achieve this result It trebled in twelve months, although at this stage it was still two kilograms below that of his Caucasian counterpart The rate of weight increase is most rapid during the first three months and exceeds that of English babies , it then slows down to follow the English figures at a lower level The author attributes the diminished rate of increase after four months to the influence of disease , he does not indicate the height of his subjects nor of their mothers, and no details of the diet are given

Figures from the Marind regions (LUYKEN and LUYKEN-KONING, 1955 , VEEGER, 1959) indicate a rate of weight increase closely similar to U S A averages during the first six months In babies weighing 3 400 g at birth, the increase was even greater At twelve months there is, however, a difference of 1 5 kg The Marinds are tall Papuans and their diet is fairly satisfactory The height increase shows the highest figures so far reported from New Guinea

Series of comparable field determinations of Chimbu and Nubuai (OOMEN and MALCOLM, 1958) and of Nubuai and Biak (JANSEN, 1959) suggest interesting differences between the three groups At Nubuai, the slowing down in weight increase starts early

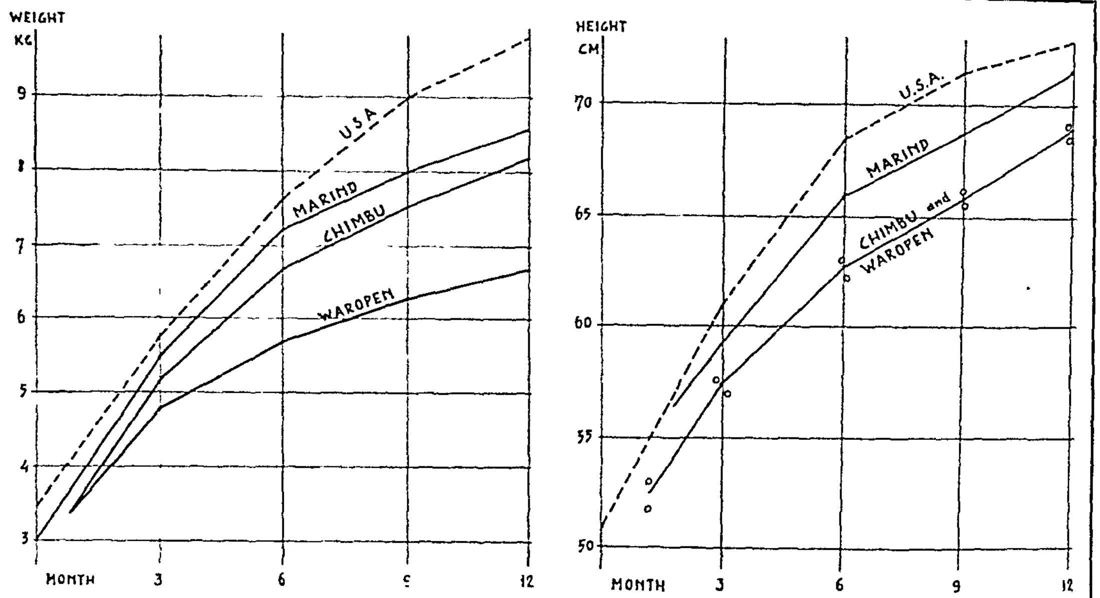


FIG. 8. Weight and height increase in the first year in three regions of New Guinea. Differences in weight increase emphasize nutrition ; in height increase emphasize racial group.

and is pronounced. The weight of 12 month old Nubuai and Biak babies average 6.7 kg. ; the Chimbu baby attains 8.0 kg. But the height increase of the three groups is almost similar (Fig. 8).

Pending further evidence on the respective influences of race, nutrition and infectious disease on the growth of the Papuan infant in the first year we conclude : (1) that weight increase rate is similar, if not better, than in European babies during the first 3-6 months and this is due solely to breast-milk ; (2) that there is a relation between the maternal diet and the point — between three and six months — at which the retardation in weight increase sets in ; (3) that the Papuan toddler, though with considerable variations, is smaller and lighter than Caucasian counterparts.

Both the production and the consumption of breast-milk in New Guinea appear to be singularly efficient processes, especially where dietary conditions are marginal. The differences in weight increase strongly suggest interference by nutrition as an environmental factor ; the differences in height increase between racial groups may suggest a genetic factor.

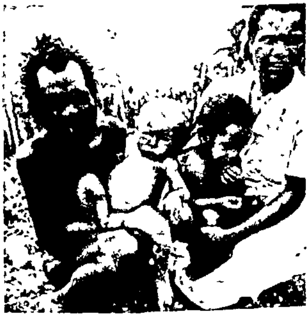
The influence of disease, when comparing malarious and malaria-free regions, is not convincing. Malaria probably behaves as an incidental killer, as a producer of short periods of acute illness, rather than as a constant depressor of the growth rate in survivors. DRAPER and DRAPER (1960) commenting on the influence of malaria on the growth rate of African infants, did not find a specific effect of malaria control ; they noted, however, frequent weight losses connected with diarrhoea and, though less severe, with upper respiratory infection.

Blood composition. As in the case of the pregnant and lactating woman, we wonder about the effect of diet on the blood composition of the growing child. JANSEN (1959) again furnished some evidence in the nutritionally poor surroundings of Nubuai and Biak, and in the more satisfactory conditions of Sorong (Table IX).

TABLE IX. Blood values of Papuan children with increasing age.

Region (No)	age (years)	Hb g %	RBC mill.	Total protein g %	Albumin g %	γ-globulin g %	Alb/glob. rate
Nubuai(1)							
(9)	1— 2—	8.9		6 4	3.0	1.7	0 9
(62)	2— 6—	8.3		6 6	3.0	1.8	0 8
(120)	6— 12—	8.7		6.9	3.3	1.9	0 9
Biak(1)							
(23)	1— 2—	8.1	2.7	7 0	3.3	1.8	0.9
(66)	2— 6—	8.2	2.8	7.0	3.2	2 2	0 8
(30)	6— 12—	8.5	2.9	7.3	3 2	2 5	0 8
Sorong(1)							
(9)	1— 2—	10.1	3.2	6.6	3.6	1 3	1 2
(28)	2— 6—	9 6	3.1	6.8	3.7	1 5	1 2
(33)	6— 12—	10.5	3.4	7.0	3 6	1.7	1 1
Chimbu(2)							
(13)	1— 2—	11.4		6.5	2.5		
(32)	2— 6—	12.2		7.0	3.0		
(79)	6— 12—	13.9		7.9	3.3		

(1) JANSEN, 1959. (2) VENKATACHALAM (in press) ; haemoglobin figures not corrected for altitude (about 2,000 metres).



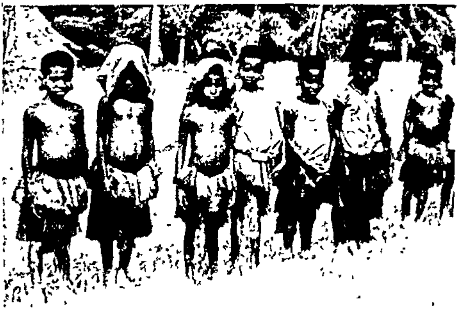


FIG. 9. Papuan kwashiorkor. (Note contrast with healthy counterpart and between respective parents.) (Photo : Dr. J. v. d. Hoeven.)

FIG. 10. Schoolgirls of a less primitive region (Sepik).

Haemoglobin values were low at the two former sites and normal at the latter. This could be ascribed both to nutrition and malaria. But the similarity of figures in malaria-free subjects and regions emphasizes the role of nutrition.

The figures for albumin are rather, although not strikingly, low in the second year. It would be difficult to state whether the absolute levels or the relative percentages are outside the range of normality. Jansen attributes the relatively low levels for gamma-globulin at Sorong to the lesser burden of infection. Reviewing the further evidence produced, and bearing in mind the very low protein intakes of the Nubuai and Biak children, it is again remarkable that he found so few low values, associated with protein malnutrition.

Physical condition. Serious malnutrition cases, either in infants or in toddlers, are no rarities in the "poor-food" regions. Marasmus, kwashiorkor (*Fig. 9*) and xerophthalmia have been reported by several authors. As long-term observation facilities are scarce, an assessment of the relative importance is hardly justified. Rickets is not rare in the dark pile-built houses of the sago-eaters (OOMEN and MALCOLM, 1958). In several high valleys goiter and cretinism in children are problems.

TABLE X. Physical values and infection rates of Papuan children.

Region age yrs.	Weight kg(1)	Height cm(1)	Liver-size cm.	Parotoid swelling %	Spleen(2) rate %	Parasite(2) rate %	Active(2) yaws %
Nubuai(3)							
1— 2—	7.6	73	1.4		16	0	
2— 6—	12.4	94	2.9	58	57	25	8
6— 12—	16.6	112	2.2	83	65	20	7
Biak(3)							
1— 2—	8.1	72	1.4		67	18	
2— 6—	11.8	90	2.4	78	77	32	13
6— 12—	19.0	115	3.0	97	89	15	12
Sorong(3)							
1— 2—	8.8	77	0.5		0	0	
2— 6—	13.5	96	1.3	18	18	0	0
6— 12—	20.3	119	0.7	33	33	0	0
Chimbu(4)							
1— 2—	8.5	75		0	—		
2— 6—	13.1	91		4	—		
6— 12—	21.6	114	(5)	41	22		

(1) Height and weights at central ages of 1½, 4½ and 8½ years respectively.
(2) Before starting malaria prophylaxis and yaws campaign (1955-1957).
(3) Jansen, 1959.
(4) Venkatachalam, in press.
(5) 41.4% "enlarged livers."

We compared the physical conditions of child populations in diverse regions. There were significant differences for instances between Nubuai and Ajamaru. In the former place a large percentage showed flaccid thin muscles and a dry atrophic skin and an inclination to potbelly. It should, however, be stated that the sometimes skinny appearance did not always seem to impair their vitality. We have seen beautiful babies of 10–12 months, exclusively reared on breast milk, sometimes even with an enlarged liver and spleen, indicating a compromise with malaria. There was clinically little to criticize and much to appreciate in the state of health in the majority of infants, toddlers and school age children (Fig. 10) at Ajamaru and the Sepik: on the whole, disregarding their smaller body build, they would compare favourably with white counterparts in affluent societies.

In nutritionally poor surroundings parotid enlargement is a rather frequent sign in older children. There was a high prevalence at Biak and Nubuai, while at Sorong the incidence was low (Table X) (Jansen, 1959).

Liver enlargement. Lipotropic factors are scarce in New Guinea diets, especially in connection with the low-protein food. They are easily dominated by the carbohydrates, but not everywhere to the same degree. This, we suppose, was the principal cause of the differences in liver size encountered. A next probable reason for widespread liver enlargement is recurrent malaria (Black, 1954; Peters, 1959). There is no other known ubiquitous agent to which the high prevalence of large livers can be ascribed. On the other hand, subjects with large spleens always showed a larger average liver size than their local counterparts without spleen enlargement (Table XI). At the same time, significant differences existed in subjects without enlargement of the spleen in different localities (Oomen, 1957). In our survey large livers were prevalent at Nubuai, as contrasted with Ajamaru and Sepik; in Jansen's survey Biak and Nubuai presented widespread liver-enlargement as compared with Sorong. In the average Nubuai toddler, the palpable portion of the liver would measure four centimeters in the median line and 1½ in the right nipple line, if he belonged to the 'no spleen' group; in malarious subjects these values would be five and a-half centimeters and two centimeters respectively.

Table XI. Differences in average palpable liver size*, supposed to be of dietary origin ('no spleen' groups) and/or due to malaria ('large spleen' groups)

Region (numbers)	Ajamaru (259)	Nubuai (379)	Sepik (211)
Infants, no spleen	0.5	1.9	
large spleen	1.8	2.7	
Toddlers, no spleen	0.9	2.7	1.0
large spleen	2.2	3.6	2.2
Schoolage, no spleen	1.0	1.6	0.4
large spleen	2.2	3.0	1.1

* *Average palpable liver size* is half of the sum of the measures in cm. of the palpable portion in the median line and in the right nipple line.

A moderate enlargement is usually otherwise symptomless. Jansen could not demonstrate a consistent relationship between serum protein levels and liver enlargement

PROSPECTUS FOR A CHILD HEALTH SERVICE BUILT AROUND PAEDIATRIC CLINICS

by

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The services to be described may be centred in a hospital (out-patient department), a maternal and child welfare centre, a primary health centre or a dispensary. If they are a part of a larger service, their aims, activities and personnel should be fully integrated with those of the larger service. If they function alone, their activities should be related, in terms of referral and liaison, with other services available to children in the area.

The basic aims of this service are the same as those of a conventional child health service—the prevention of disease and the promotion of health. However, the means by which it seeks to achieve these aims, though having some aspects in common, differ from conventional services in that the treatment of ill health is an integral part of the scheme and certain aspects of health supervision (scheduled medical appraisals and scheduled weighing of infants) are not part of the scheme. The reasons for these " deviations " as applied in India are as follows :

(1) As many observers have pointed out, the present pattern of child health services in India (MCW programme) is more of an historical accident than an approach to the solution of existing problems with existing personnel.

(2) There are not enough medical and paramedical personnel to begin to give adequate service to sick children, yet the adequate, thorough treatment of sick children would in itself help prevent further sickness. The usual services to sick children are rarely thorough and thus rarely completely curative, much less preventive in their effects.

(3) The basic preventive aspects of western child health services and the only services of proven value—immunization, advice on infant feeding, and to a lesser extent advice on other aspects of child care—need not be given by physicians, although they should be given under medical direction. There is no evidence from anywhere in the world that scheduled weighing and the examination of well children by physicians *per se* have had any significant effect on the prevention of disease or the promotion of health, except for their possible effect on the mother's peace of mind. In western countries this latter point is probably of more practical importance than it is in India.

(4) Motivation of Indian mothers to bring their children to the centre when the child is well, is lacking. Therefore, it has to be stimulated artificially by making the distribution of food or milk contingent upon clinic attendance or by building a kind of associational magic into the ritual of weighing the baby. On the other hand, there is usually strong motivation to seek help when the child is ill. If the source of care for sickness can be made satisfactory to the mother, it seems logical to suppose that the mother may be more willing to accept purely preventive services such as counselling and immunizations from the same source.

(5) Conventional U.S. child health services, perhaps because of their connection with maternal health services, perhaps because of the helplessness of infancy, perhaps merely because of tradition, focus sharply upon the first year of life and within this year, upon the first six months. From the point of view of health and disease in India, these first six months are a time when routine health supervision is probably less necessary than at any time in childhood. Where exceptions exist (because of maternal lactation failure or similar reasons), very intensive supervision on a continuing basis is often called for but cannot be delivered because of the spread of service to others less in need of it. Focussing the health supervision and preventive counselling around a clinic for sick children automatically directs attention to an older age group and automatically tends to select the most vulnerable children for the most intensive supervision.

(6) The number of acute episodes of illness (skin, respiratory and gastro-intestinal infections) among Indian children is so great, that if a mother sought care for each episode, her children would probably be seeing a doctor far more often than is demanded by the most rigid schedule of medical supervision for well children. The personnel serving children in a pediatric clinic are therefore in a more favourable position to give health supervision than the personnel in a well baby clinic, providing their minds are attuned to children rather than to diseases. The more children there are in the family, the more emphatic this truth becomes, providing the mind is attuned to families rather than individuals. The amount of sickness in a family is always proportionate to the number of children in it.

SERVICE ACTIVITIES

Those would consist of clinic or centre activities and the visiting of homes by the health visitor.

Clinic sessions or activities in the child health centre itself may be regularly scheduled for one or more of the following purposes:

(i) Medical examination and treatment of illness (physician and health visitor)
(ii) Performance of laboratory diagnostic procedures (physician or laboratory technician)
(iii) Immunization (health visitor)
(iv) Distribution of drugs and diet supplements (health visitor and other staff)
(v) Group meetings of mothers (health visitor)

Conceivably, if sufficient personnel and space were available, all five of these activities could be conducted simultaneously for different groups of patients. This will rarely be the case, however. With the possible exception of the first two, it will usually be desirable to schedule them at different times so that each can be carried out properly. Patients coming to the clinic solely for renewal of drugs or diet supplements should not be confused with patients needing medical appraisal. Health counselling (see next section) would be done at all the above clinic sessions, especially the first and the last. Home visiting by the health visitor is an integral activity of the total service. Even though the purpose of a visit may relate only to one child, the health and condition of other children in the family would be inquired into at the same time. In addition to the type of activities described, conferences or demonstrations for individual mothers at the centre may sometimes be useful.

General Principles of Service

(1) The treatment of illness is the foundation upon which other features of the child health services are built. In some cases it will be the means through which the family is introduced to the child health programme. In all cases, it is the principle means by which continuing contact with the family is maintained. It should differ from a conventional dispensary service by including minimal assessment of growth and development in the content of medical appraisal during episodes of acute illness, by looking beyond the presenting complaint for signs of more than one disease process, and by looking beyond the germs precipitating infections to the social background that favours their growth.

In addition, health counselling is an integral part of the clinic routine (see later). *If treatment is neglected or done in a fragmentary or cursory manner, other aspects of the child health programme will also suffer.* On the other hand, even in its fullest sense, treatment of diseases should not be regarded as an end in itself. The preventive aspects of the child health programme may be as important in the long run.

Diagnostic laboratory and x-ray work is desirable, if available. Minimum laboratory procedures would include urinalysis, haemoglobin determination, tuberculin testing and microscopic examination of stool specimens and blood smears.

(2) Immunizations should be regarded as part of the child health programme whether they are carried out by child health service personnel or by others. Routines for the use of smallpox vaccine and D.P.T. should be developed where these agents and refrigeration facilities are available. *B.C.G. immunization is probably most efficiently given during the newborn period.* Therefore, its use in a child health service built around a pediatric clinic should probably be deferred until after the routine B.C.G. vaccination of all babie born in hospitals and maternity homes in the area, is an accomplished fact. On the oth hand, diagnostic tuberculin testing (in the absence of mass B.C.G. vaccination) desirable and it may be relatively simple to vaccinate tuberculin negative re routine.

(3) *Health counselling should be looked upon as the principle hallmark* health service. It is a feature which distinguishes it from ordinary treatm zation services for children and which ties all activities together. Its spec its preventive aims must be delineated by balancing a knowledge of the ca spread of the most prevalent diseases and an understanding of the soci culturally conditioned behaviour which favours them, against a realistic chances of changing such behaviour and the effect of such a change of disease and the promotion of health. *Often the preventive aims wil* peutic ones of necessity. Although local conditions may differ, br earlier introduction of solid foods, increasing the protein and mineral of the usual diet, encouragement of breast feeding for as long as the it, development of sanitary defaecation habits, promotion of famil explanation of the cause of the disease and the effect of treatment elements likely to be common to all localities. Some of these aim introduction of solids can be attained solely by behavioural cha modification of the diet may have an economic determinant as well sanitary defaecation habits may need to be integrated with a latrine to be effective. Health counselling is not to be thought of as a It should infiltrate all activities of the child health programm effective counsel may arise in the course of treating an illness at the time of a mother's visit to the centre or a health visitor

meetings of mothers conducted by the health visitor may be regularly scheduled for both preventive and therapeutic purposes However, they should not necessarily deal with the same subject, and not necessarily include all mothers They should focus sharply on only few simple points and these points if possible should be common problems to all the mothers asked to attend the class and thus serve to motivate attendance and willingness to learn Mothers of children with the same problems, but complicated by still other problems interfering with their solution should, if possible, not be asked to the same meeting An example of such a grouping would be that of mothers with children already introduced to solid foods, who have brought their children to the clinic with symptoms and signs which concern them and which reflect protein deprivation There will be other children not yet introduced to solids with similar signs and symptoms, but their problem is compounded by the fact that they have never experienced solids If the focus of the meeting is to be around providing the children with a cheap source of additional protein, such as pulses in fairly large quantities, the resistance of mothers of the children who have never received solids at all may interfere with the effect on the rest of the group This is only an example of the kind of meeting that can be held and the application of a principle to a specific kind of meeting The nature of the meetings scheduled and the selection of mothers to be invited must be individualised in each programme depending upon knowledge of local customs and practices Home visiting is another activity whose principle value is a counselling one A visit may be made in connection with the treatment of an illness or its follow-up, in connection with the immunization programme, as an introduction to the programme, or—rarely and exceptionally—as a check on the child's progress when contact with the centre has not been maintained In any case it should never become a mere routine and the number of visits expected should be small enough so that each visit will be an effective teaching contact It is better to sacrifice quantity to quality Cases may be selected for home visiting by making common-sense judgements of the seriousness of a condition, the need for teaching, and the teaching receptiveness of the mother It is possible that in urban areas, when the sole purpose of a visit is to ask the mother to follow up a broken appointment, post-card reminders may be effective The techniques of effective health counselling cannot be dealt with here However, it would be well to recognise that this is a field which is virtually unexplored and that few doctors and health visitors have had the training and experience to introduce them to it This is especially true of the techniques of interviewing and of group discussion which have little in common with usual medical history taking or speech making These are not easy deficiencies to remedy, but they need not block achievement In its own way, the challenge to gauge accurately the force, direction and associations of a practice or attitude inimical to health, is as complicated as the accurate diagnosis of an obscure syndrome, and the challenge to devise motivations which will lead the individual or group to modify this practice or attitude, is as great as the challenge to discover a specific treatment for a disease for which none presently exists If these challenges are accepted, and acted upon, experience itself can become a learning process

(4) Diet supplementation with vitamins, minerals and protein containing foods, although as essential aspect of service, must neither be allowed to overwhelm other aspects nor used as a bait to attract clientele If either occurs, the distribution and consumption of supplements becomes an end in itself and neutralizes the potential value of these other aspects It is true that in view of the gaps in food production in India, supplementation of children's diets could be considered an end in itself However, it cannot be considered the function of a child health service to fill such a gap any more than its function is to

build houses or latrines or to enrich foodstuffs or to overcome poverty itself. If Government were to make diet supplements available to all children, then it would probably be desirable for their distribution to become the responsibility of another agency or at least of other than trained paramedical personnel. Meanwhile their distribution by a child health service should work to strengthen rather than weaken the other aspects of the programme. The aim of the child health service should be to induce families to feed children a kind of diet, using the available cheapest foods, which will need no added supplementation. Complete achievement of this aim, even in the presence of willingness to comply with advice, may be blocked by poverty. However, the child health service cannot overcome poverty and the measure of its success in achieving its objectives will be the degree to which adjustment to existing conditions and the maintenance of health are compatible. For these reasons, with one possible exception, diet supplementation should be used as a temporary rather than a permanent measure in any given case. In a sense this is a therapeutic rather than a prophylactic use, but the therapy should begin early and should terminate only when, insofar as economic circumstances permit, the lacking nutrient is being supplied from available foods. The exception is the use of vitamin A and D supplements, since these are not usually available in adequate amounts in available foodstuffs. However, even in this case, a real effort should be made to have those families who can afford to do so purchase the cheapest available pharmaceutical preparation. This will often be relatively inexpensive and within the means of many families. In some circumstances parenteral injection of mineral or vitamin stores might be justified as a prophylactic measure, but this remains to be demonstrated.

(5) Records and reports of service should be kept to the barest minimum necessary to ensure function. Some sort of permanent continuing record with all children in a family grouped into one folder will be necessary. An efficient means of locating such folders and some sort of tickler or reminder system using cards and/or appointment registers for checking up on scheduled visits to the centre, home visits and record reviews will also be needed. The smooth functioning of the record and follow-up system is far more important than the accumulation of statistics or the precise accounting of drugs and diet supplements. If there is a permanent record for each family, it should be easy (without extra effort) to keep track of the total registration. If there is an alert system of home visiting, it should be easy (without extra effort) to keep check on the use or disposal of prescribed drugs and dietary supplements. Probably the only figure other than registration worth tallying on a routine basis is a simple count of the numbers of children and mothers who receive the various services that are part of the programme and the number of times such services are rendered. If the records are kept up it should be easy from time to time to sample them for special information, if desired (viz. recorded prevalence of types of illness or nutritional problems, weight curves, proportion of registered children completing immunization courses etc.). This is a more accurate and less time-consuming method of obtaining such information than attempting to collect it on a current basis. Furthermore, since it can be adjusted to personnel time, it does not give the collection of numbers priority over the giving of service as tallying routinely on a current basis tends to do. If accurate or unusual data (such as heights, body measurements, true incidence of parasitic infestations, etc.) are desired, special methods, forms and training of personnel are called for. Accurate studies cannot be expected from material collected by a purely service giving programme, although the programme itself may afford a medium for the carrying out of such studies.

EXAMPLE OF A WORKING PROGRAMME

To clothe these concepts with some semblance of reality, a specific example of its working will be described It is assumed in this example that the child health service is in an urban area and is closely integrated with a maternal health service, that the mother is informed during pregnancy about the existence of clinics to care for illness and immunize against disease, that babies are delivered in hospitals or maternity homes (this is the situation in most of the large cities in India) and immunized against tuberculosis before discharge, that home visiting in connection with the maternal health programme is dovetailed with home visiting in connection with the child health programme so that duplication of this activity is avoided

The child health services, having been informed of the birth, would make its first direct contact with the family at home or at the mother's visit to the centre for post-natal care The need for a home visit during the first few weeks after birth would depend upon how well the home was already known and whether satisfactory contact at the time of a post natal clinic visit could be arranged At this first contact (in home or centre) various aspects of infant care such as breast feeding and bathing might be reviewed and advice given on other matters depending specifically upon local customs (viz caution against use of castor oil) At the same time the mother could be reminded about the sick children s clinic, encouraged to bring in her child for early treatment, if necessary, and the immunization programme could be explained The mother would be asked to be sure to bring her child to the clinic at two months of age to begin immunizations

For the next four months, at four or five week intervals, the mother would be expected to bring her child to the centre for immunizations, first against smallpox and then for completion of a course of triple vaccine At these visits, some attempt at explanation of the immunizations can be made, the baby can be weighed and progress inquired into by the health visitor Somewhere between four and six months of age (during visits for immunizations) the subject of solid food introduction would be discussed, planned for, and carried out This subject lends itself well to group discussion so that scheduled group meetings for mothers of infants who have not yet been given solids might be used to reinforce individual counselling If the mother has failed to come at all by the time the baby is three months of age, if she fails to keep up with her planned immunizations, a home visit would be made and the cause of her failures dealt with

Visits of the mother to the centre for treatment of episodes of acute illness are relied upon as the main source of future contact At these visits weights may be taken and preventive health counsel given as well as the acute illness treated The use of a continuing record initiated at the time of first contact will enable growth to be assessed In many cases the details of preventive health counsel will be best postponed for a few days until the illness is controlled, but it may still be given as a part of the clinic, group meeting, or home visiting routine, the need for it having been assessed at the time care is sought for illness In all cases, home visiting to supplement clinic treatment, reinforce counselling, check on failure to keep return appointments etc should be used as liberally as possible Group meetings to reinforce advice or give special kinds of advice would be regularly scheduled The selection of mothers for home visiting or attendance at group meetings would need to be individualized with priorities set to accord with available personnel time An important element in selection is follow-through to completion of a treatment or dietary routine prescribed on the basis of need

As a further check on the child's health, records would be reviewed at the time of the child's first birthday. If contact has been maintained reasonably well and there are no outstanding problems, nothing more need be done. If this is not the case, a home visit would be made. The main focus of attention at this time would be the adequacy of the present diet particularly with respect to protein and iron containing foods. If the diet is inadequate or the child is unwell, the resources of the centre (sickness treatment and group classes) would be brought into play.

This programme has been described merely as an example of the application of principles to specific problems. However, the essence of these principles is the fact that their adaptation to different circumstances should result in different programmes. The main caution in applying the principles is to beware of over-extending the programme to such an extent that it cannot be carried out as planned. The main guide channel to their successful application is continuing assessment of whether the programme is being carried out as planned and a willingness to change the plan when this is indicated.

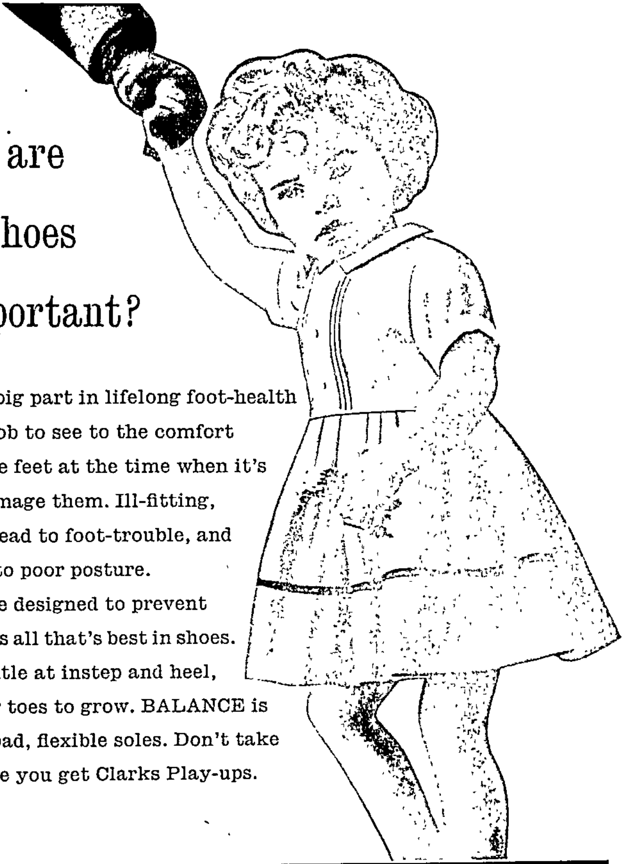
It is recognized that one of the weaknesses of a programme of this nature is the fact that doctors and health visitors may be neither prepared nor accustomed to exercise the kind of individual judgement which the programme demands, and supervision to help them acquire the technical competence and self-confidence required is at a minimum. This is a matter of selection and training in the long run.

However, it may be possible to simplify some of the judgements by routinizing certain decisions left open in the previous discussion, such as selection of cases for home visiting and attendance at group meetings, providing routinization does not swamp service. A second weakness is the expectation of planned and scheduled behaviour on the part of the mothers. However, this is a weakness of any programme that would seek to deal successfully with child health and disease in underdeveloped countries. The best that can be hoped for is that it will be slowly overcome.

EXCERPT

MEGALOBLASTIC ANAEMIA OF INFANCY IN JAMAICA (McIver, J. E. and Back, E. H. *Arch. Dis. Child*, 1960, 35, 134).

The clinical, haematological and other laboratory findings of 50 cases of megaloblastic anaemia are presented. Almost all were very malnourished. In the authors' view, deficiency of folic acid seems likely to be important.



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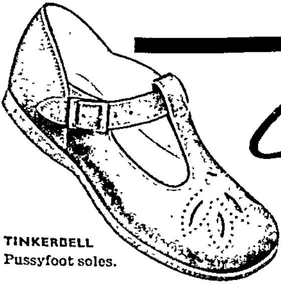

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COMMUNITY DEVELOPMENT AND CHILD HEALTH IN BUGANDA

by

PUMLA KISOSONKOLE

(Community Development Officer, Mengo, Buganda Uganda)

Caring for her child is one of woman's traditional and natural tasks, and therefore any plan which has this slant is bound to have an appeal to women. One only has to look at the nice shiny magazines for women to see that a successful journal or magazine always bears a column on " Mother and Child ". Therefore, working on this principle the Community Development department is able to push its educational schemes gearing them on to this desire on the part of the mothers, and indeed fathers, to have healthy and happy children.

Buganda, on the whole, is one of the lucky parts of Uganda as far as food resources are concerned. As there is a natural desire on the part of most parents to have nice looking children, one concludes that where children are not so well-fed or even badly fed, the reason behind it is ignorance of the part played by the right kinds of food in the development of a child's body. As babies on the whole are inclined to be born in very quick succession of one another, it is usually assumed by most parents that it is natural for the youngest baby to fret and look ill whilst the next one is coming. Therefore no remedial measures are given for the child. It is in a situation like this that Community Development comes in and offers helpful advice.

Ordinarily, cases of malnourished children would not be known even to the staff of Community Development, but what brings them out are the group of women organised for instruction in other skills, the lack of which is felt by the women as a pressing need at the time. Before the work of the Department was better known, most women organised themselves into groups in order to receive instruction in embroidery. As there is usually no " mother's help " with whom to leave the children at home, mothers usually bring them to the adult classes. This then gives the Community Development staff an opportunity to see the children, and if they are obviously not well-fed and looking rather ill, it is an easy thing to give individual advice to the women and to find out if they would like to have instruction on the care of their children in addition to doing embroidery. This is usually accepted very eagerly and so the next step is taken, that of arranging instruction on how to feed the child. This enables the parents also to see the advantage of feeding the child before it is born, nursing it after it is born, and the importance of starting it on supplementary feeds so as to give it a strong healthy body before it stops feeding from the mother's milk altogether. This also leads on to the value of keeping the older children well fed, and special mention is made of the feeding of the school-going child, using available protein-rich foods, especially such foods as can be carried by the children in small parcels when they go to school.

Sometimes the mother, through the women's groups, may be convinced of the value of finding a child extra milk, but the father, who was not at the mothers' meeting may prove difficult and may force the mother to believe that all that is wrong with the child is that the next baby is coming. In order to convince both parents another approach is made by the Community Development staff. Many people these days know about the women's groups and greatly appreciate the progress the women have made through them. Therefore it is with great pride that men encourage their wives to start a new group and to invite the Community Development Officer to open it. This is usually made into a festive day with wives and husbands in attendance, and non-members are invited, as well as men who are known to be against their wives joining the group. The chief and other important people in the community, such as members of local councils etc., are also invited. A programme of songs, dancing and plays is performed by the newly-formed group, and everyone is in a happy mood.

This is an excellent opportunity for the Officer, when her turn on the programme comes round, to make apt remarks on the aims of women's groups of the Community Development Department. Child health always comes in, and this usually brings forth remarks from the audience that the children in that community are not very well — they are always suffering from fevers etc., and can the Officer use her influence with the Government so that a doctor can be sent out to examine the children. The Officer replies that she knows the Government will do its best when they get more doctors, but in the meantime would the community be willing to do something for themselves in order to reduce the children's illness ? Would they be willing to make a clearing around the house and the compound so that mosquitoes will not breed ? Would they be willing to let fresh air into the houses by inserting ventilators and in some cases putting in windows ? Do they know that some of the children's illnesses could be prevented if they are fed with the right foods ? and what foods do they grow in their gardens ? Would they like a member of the Community Development staff to come and help them with these ideas ?

Approval is usually given, and members of the Community Development staff are sent out to live with the community gradually improving the look of the village, as well as improving the health of the children. In this effort, Community Development co-operates with other departments of Health, Agriculture and Veterinary Services, and the child welfare side of the Medical Department ; and above all, with the local chiefs. The complete picture in an improved village usually looks something like this :

> Roads have been made leading to the vital parts of the village, and therefore visiting experts can come freely and go to any part of the village. Each homestead has had windows and ventilators fitted in, bright curtains are hanging from the windows, the walls have been smoothened and sometimes white-washed, floor mats have been woven, decorative baskets are hanging on the walls ; a kitchen has been improved or a new one built, with a smooth smeared floor and containing a raised mud-stove, a space for storing firewood, a storage space for the water-pot, and a rack for storing food-baskets, pots and pans and any equipment used in the kitchen. The outhouses consist of a well-finished deep latrine, a bath enclosure, and chicken and goat houses. The front of the compound has been planted with grass, and flower borders ; vegetable gardens have sprung up and pawpaw trees have been planted.

Throughout this maze, a clear and valuable thing stands out, and that is, with the pride in improving the home, has developed the pride in the welfare of the child. He is now able to live in better surroundings, has better food, and a better-housed school is provided and altogether the child begins to enjoy better health without necessarily having a doctor to visit the community

In some communities where the women's groups have been well established, it sometimes becomes necessary to arrange a Community Day The idea behind this plan is to highlight the family A programme is arranged to take in the interests of father, mother, baby, school child, and sometimes the adolescent This is usually done with the co-operation of chiefs and the local school

The Community Development Officer is invited with her staff to arrange a teaching programme for a certain prearranged day The teachers and the women Club members invite the chiefs and the people, men and women, of the locality This gathering is held either in the school or at the headquarters of a chief Men and women, and the school children form this gathering The Community Development Officer gives the main talk on the role of women in the community, and the need for co operation between men and women in building home and family This talk is usually well received by both sexes , and then the whole group divides up into two sections, one section goes to see a demonstration by a Community Development Assistant on foods required by an expectant mother etc , and leading on to preparation of foods for a baby during the weaning period the second section goes to where the Community Development Assistant is demonstrating nutritive foods, and how to make food which children can take with them to school The groups are organised so that the children kneel in front, the mothers stand behind them, and the fathers bring up the rear Questions are asked by children and parents alike

This is followed by a lunch prepared beforehand by the mothers' communal effort, and the community and the school partake freely Singing and dancing are a feature of this activity, and they are organised by the women's group who are anxious to show off what they can do as eagerly as they are to display their embroidered curtains etc Sometimes a football match bring in the youths of the community, and brings the day to a close

Sometimes when a local women's club is scheduled to be opened, the headmaster and staff either invite the Community Development Officer to have a special word for the school , or the children, particularly the girls, are allowed to file in to the meeting place so as to listen to the talk given to their mothers and, quite often, fathers as well This happens in many cases where the women's group meets at or near a School Many of the teachers see this idea of teaching the parents as a supplement to their own efforts at teaching the young, and therefore do not resent but welcome the Community Development activities Here again the health and welfare of the child stands out as part of the Community Development activities

Various training schemes on child health and care are undertaken at different levels In the training of the staff it forms an important part Various leaders who are given a training course have it included in their programme The Uganda Branch of the British Red Cross have worked out a simple course which is designed so that women who do not have much educational background can benefit from it It is arranged in three parts, at the end of each of which an examination is set for the candidates, and only those who make the grade are allowed to do the next part, Those who do well in this part can go on to the third, the passing of which entitles them to being recognised instructors in child care This has meant that there has been an increase in the number of women who can be entrused with instructing others These courses are very popular and they do ensure that many mothers are given a good knowledge of how to have healthy children

BOOK REVIEWS

A New Tropical Hygiene. *(1960).* By L. Goodwin and A. J. Duggan. London : George Allen and Unwin Ltd.

The most difficult form of instruction is to groups who know little or no medical technical jargon, especially if their knowledge of English (or other language of instruction) also is imperfect. And yet, at ultimate analysis, it is to these groups that health education most needs to be directed.

It is universally recognised that in tropical regions school teachers (and through them their pupils) are one of the most important groups for health education, and this can only be based on a reasonable understanding of the elementary facts as to how the human body works and the main types of disease process.

This inexpensive booklet is intended for this purpose and it can be recommended. It is clearly written, with striking, original and helpful iillustrations.

It is, perhaps, a pity that nutrition and diet, so important to health in the tropics, receive little emphasis. Perhaps in future editions some mention may be made of kwashiorkor, breast-feeding and similar aspects of " tropical hygiene." In addition, more stress should be given to cultural factors in relation to health in the tropics, probably the main hidden barrier to change.

However, to reiterate, there is no doubt that this booklet will be very valuable (if used selectively) for junior teachers in training, and in schools.

Neurology of Infancy. *(1959).* By A. Dekaban. London : *Bailliere, Tindall and Cox.*

This booklet is excellently produced and well illustrated. It covers the complete range of neurological problems found in infants, from birth injuries to the progressive degenerations of the central nervous system.

Although at first consideration, neurology seems rather far from the ever-pressing mass of ill-health that makes up the bulk of tropical pediatrics, in fact this is not so, especially if the important place occupied by bacterial meningitis and the encephalitides is appreciated ; while such problems as mental deficiency, hydrocephalus and epilepsy are cosmopolitan in distribution.

Among the most interesting sections of the book is an early one on developmental anatomy and physiology of the central nervous system, which illustrates vividly with serial photographs and stained sections the extraordinary changes which occur in the rapidly maturing brain in the first year of life.

This publication should be on the shelves of pediatric libraries of all medical schools.

Skin Disease in the African. (1959). By G. H. V. Clarke. London : *H. K. Lewis.* £4 4s. 0d.

This is largely made up of 260 excellent black and white photographs of skin diseases — both common and bizarre — seen in the author's dermatological practice in Lagos, Nigeria — each accompanied by a short caption. No account is given of therapy. There is a useful bibliography of the various conditions pictured.

For the pediatrician this book has a definite, but limited, usefulness. It would perhaps have helped if further clinical descriptive material could have been included in the captions. There is a tendency to generalize on " the African " and his skin diseases, whereas, of course, it is impossible necessarily to be able to extrapolate results from one part of the continent to another, where the genetic " pool " and environmental factors may be quite different.

Conditions de vie de l'enfant Africain et delinquance juvenile. (1959). Centre International de l'Enfance. Paris.

This publication by the International Children's Centre of Paris high-lights one of the growing problems in the urbanising tropics, that of juvenile delinquency. Very detailed results are presented from Donala, Abidjan and Tananarive. A wide variety of possible factors are considered, including reasons for attraction to towns, broken homes, religion, influence of bars, housing and so on.

While not making for easy reading, this publication contains a mass of detail and should be available to those working in the field of social pediatrics in technically developing countries. The bibliography is particularly extensive, covering as it does literature from all over the world, including tropical regions.

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